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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR

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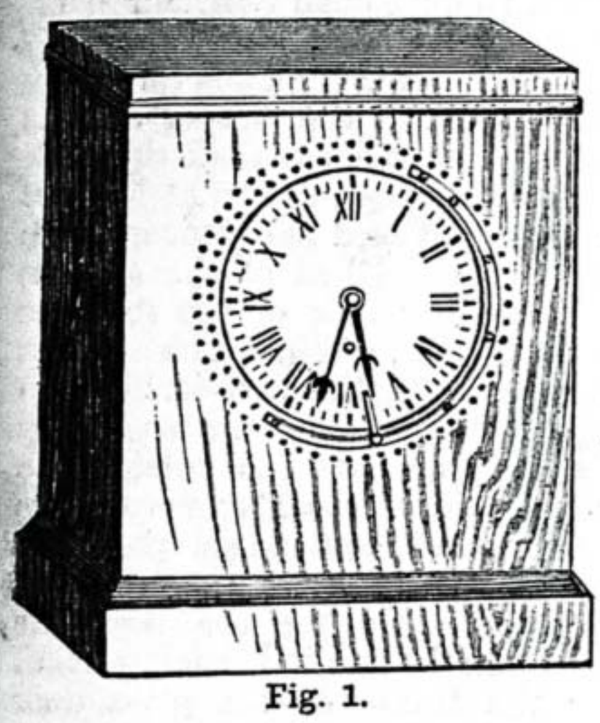

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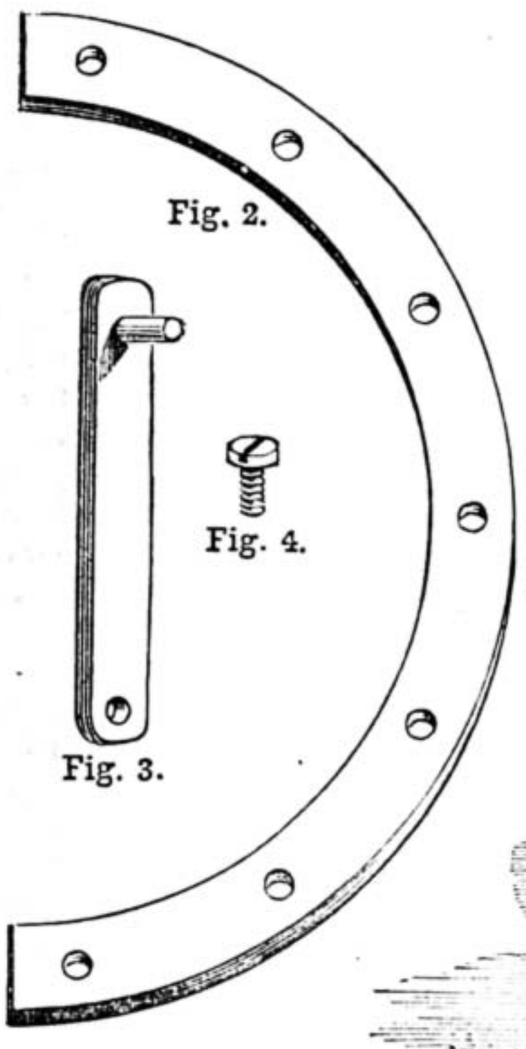

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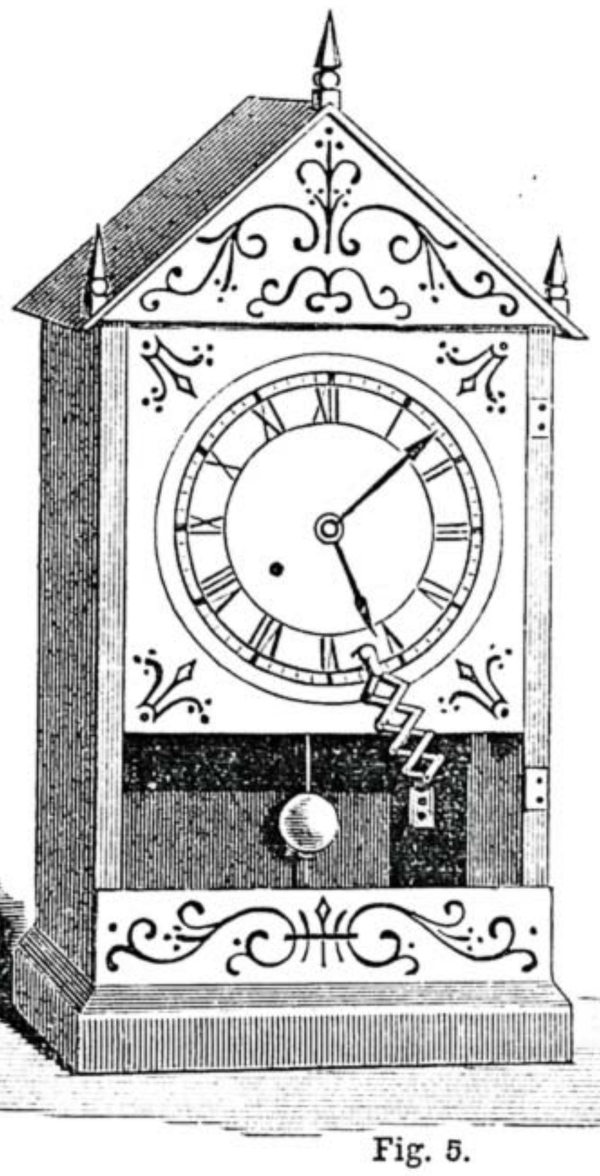

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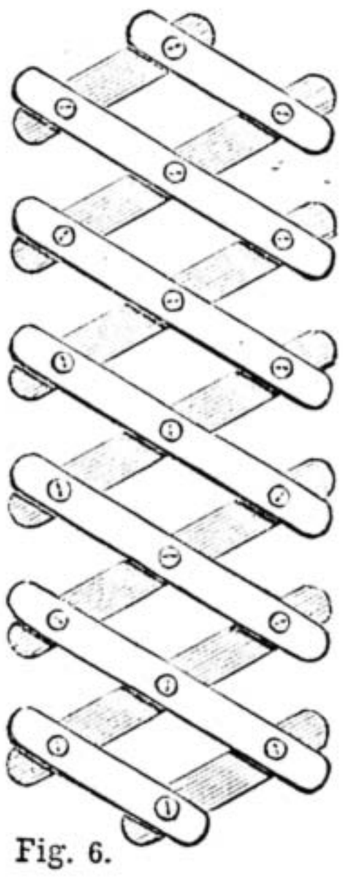

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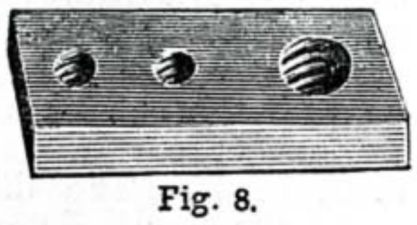

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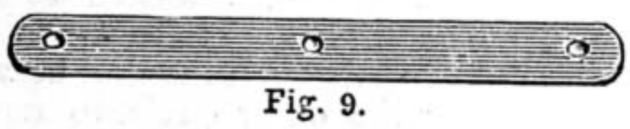

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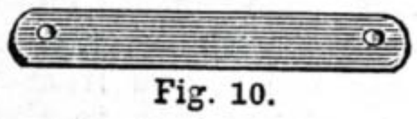

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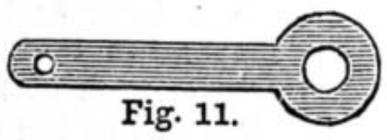

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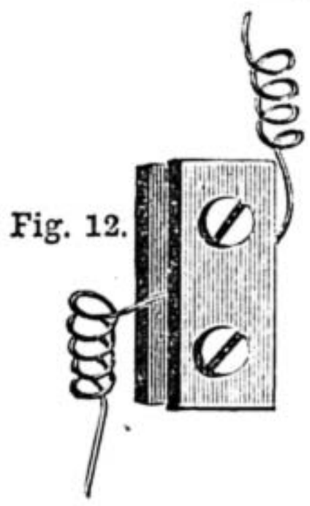

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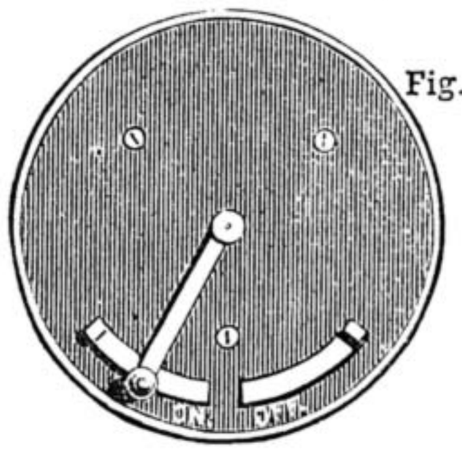

Fig. 13.

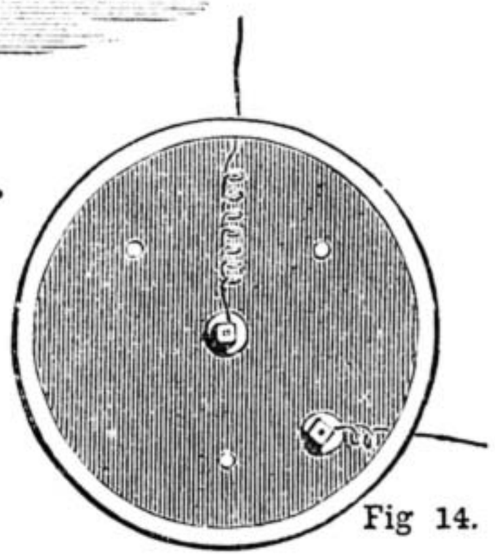

Fig 14.

Fig. 1.—Clock in Plain Wood Case, fitted with Electric Time Alarum Hand. Fig. 2.—Semicircle of Brass to hold Alarum Hand. Fig. 3.—Alarum Hand. Fig. 4.—Screw. Fig. 5.—Ornamental American Clock, fitted with Electric Time Alarum. Fig. 6.—Lattice Work Metal Arm for Alarum Hand. Fig. 7.—Brass Pillar for Arm. Fig. 8.—Foot of Brass Pillar. Fig. 9.—Link of Lattice Work shown in Fig. 6. Figs. 10 and 11.—Links for Ends of Lattice Work. Fig. 12.—Electric Connector made with two Thin Brass Plates. Fig. 13.—Plan of Upper Side of Switch. Fig. 14.—Plan of Lower Side of Switch, showing Connections beneath.

HOW TO MAKE AN ELECTRIC TIME ALARUM.

BY GEORGE EDWINSON BONNEY.

ONE of the blessings attending the enjoyment of good health and youthful vigour is the ability to sleep soundly and long. It is not only "the voice of the sluggard" we hear complain: "You have waked me too soon, I must slumber again;" for the industrious but weary sons and daughters of toil find the bed all too sweet to leave when duty calls in the early morning. I often smile grimly as I scan the advertisement columns of a newspaper and read there the frequent requirements for early-rising servants. Poor girls! Up late at nights attending to the wants, the whims, or the fancies of their employers, they must be up again early the next morning to cook, to sweep, and dust, whilst their superiors doze in bed and fetch up arrears of sleep. What wonder is it that, one morning, tired nature in the servant refuses to obey the strident tones of the alarum clock! The alarum runs down and she hears it, but the sound only strikes her *dreamy* senses, and she goes on dreaming. For a moment she dreams she is awake and dressing herself, or perhaps lighting the fire; the next moment her senses are benumbed with sleep, and she sleeps on until she loses her character as early riser. Masters and mistresses should exercise kindly consideration for these lapses, whilst us who are older should deal leniently with the late-rising offences of the young, and help them to avoid lapsing into sluggish habits, by providing for them an alarum that will not run down in a few moments, but will keep pegging away until the person to be called gets out of bed to stop it.

Such an alarum will also be found to be of great use to working men engaged in factories and on works where early punctual attendance is rendered imperative to holding a situation. The essentials for an electric time alarum are: 1. An electric bell and battery. 2. A clock of any kind, providing it is a moderately good time-keeper.

The Electric Bell may be of any size or form of the vibrating or continuous ringing type, such as those usually employed for household use. A small bell with a 2½-in.

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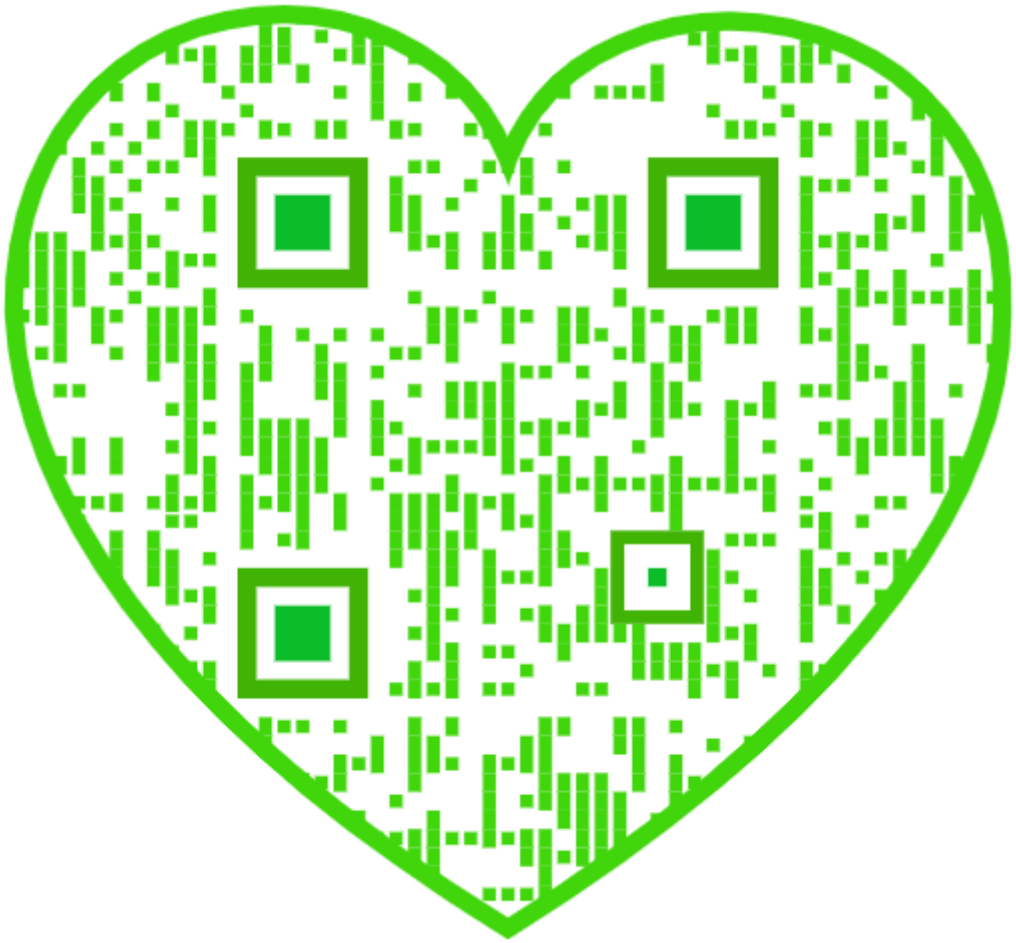

gong is preferable to one with a large gong, because the sharp sound given by the smaller goug has a better effect in arousing a sleeper than the duller but more mellow tones of large gongs. Where there exists a system of burglar alarums in the house, a bell giving a sound distinct from that of the burglar alarum bell is advisable, and, as these latter are usually large gongs with loud tones, the selection of a small gong for the time alarum ensures the necessary distinction. In the series of articles on burglar alarums recently published in WORK I have given full instructions on how to make an electric bell, and must respectfully refer my readers to those articles if they wish to know how to make the bell for themselves.

The Battery.—If the time alarum is to be set up in a house already provided with a system of burglar alarums or electric bells, we may use two cells of the battery belonging to this system, and connect them up to the time alarum. In the absence of such a battery, two large Leclanché or Gassner cells should be provided. It should be understood here that a small 2½-in. bell may be rung with current from one small cell of either class of battery, and a working man need go to no further expense than to get one cell; but experience has demonstrated the necessity of providing a surplus of power where electric bells are left to the tender mercies of domestic servants. If the bell is only allowed to ring for a few minutes at a time and then promptly switched off from the battery, a small cell will give enough current and last for a year or two; but if the bell is muffled to stop the ringing, and allowed to remain thus for an hour or two, the battery will soon run down, because current is passing through the bell coils all the time it remains muffled. In the series of articles on burglar alarums, I have given directions for making a Leclanché battery, and have shown how to keep it in order.

The Clock.—Being provided with a bell and battery, we may now concentrate our attention on the clock, and it is at this point where attention is most required. As before stated, the clock may be of any size or kind, provided it keeps moderately good time, but preference should be given by the amateur to clocks in wooden frames, furnished with porcelain or enamelled metal dials, and with a door of some sort to cover the face. This class of clock, such as the common American clocks in wooden cases, may be easily altered, and the work will not present any practical difficulties in the way of getting good insulation for the several parts.

To begin with such a clock, then, on which to try our 'prentice hand: access must be first obtained to the works. These, for the purpose in hand, should be held in a metal frame, or at least, the hour hand spindle should run in a metal bearing to which we can solder a wire. A short piece of No. 20 B. W. G. silk-covered copper wire must have one end laid bare, and this soldered to the metal in which the hour hand spindle runs. It matters little whether the part to which the wire is soldered is in front or at the side, or at the back of the works. If the frame is all of metal, it may be at some remote or easily accessible part of the frame. The wire thus soldered to the works must be brought out through the clock case, where it is likely to be least observed, and there connected by a clean bare end with a metal stud or binding screw, or some other piece of metal easily connected to the line wires of the battery. These outside connections of the clock will call for an exercise of the amateur's ingenuity in planning secret or out-of-sight means of connecting the clock with the battery, as it is undesirable to have a pair of binding screws sticking out of the top of the clock or at the sides, and wires running along in full view on the mantelpiece. If the clock has a pointed roof with an ornamental turned brass pillar on each side, these may be taken off, fitted up as connectors for the wires, and then put on again. Connection may be made between the line wire of the bell and the wire of the clock by tightly clipping them both between two tiny brass plates secured to the back of the clock frame by two short brass screws as shown at Fig. 12.

Having secured a metallic connection between the bell and the hour hand of the clock, we must now make an arrangement on the face of the clock to connect the hour hand with the battery when the hand arrives at the time when we wish the alarum to ring. This arrangement must be a surplus hand insulated from the works of the clock, and connected with the line wire leading to the battery. At Fig. 1 is shown a clock fitted with an alarum arrangement on the dial at the right-hand side. This clock was an ordinary American timepiece enclosed in a plain walnut case, and furnished with an enamelled metal dial. The face was protected by a circular glass door set in a brass frame. This I have removed, to more clearly show the alarum arrangement, but its position is shown by the dotted lines. If the clock selected is similar to this, proceed as follows:—Set a pair of compasses to the circumference of the dial, and strike out on a piece of thin sheet brass or sheet copper a semicircle slightly larger than the dial, and from $\frac{3}{16}$ to $\frac{1}{4}$ in. wide, as shown at Fig. 2. I cannot give the exact dimensions of this part, as it must be obtained by the actual measurement of the dial of the selected clock. It must not touch the dial (if this is made of metal) in any part, but should be close to it without touching, for if it touches the dial it will probably connect the works of the clock with the alarum hand and render it useless. It must also be wide enough to hold the screws employed in fastening it to the clock case, but not so wide as to interfere with the closing of the glass door. Cut this piece out, smooth the edges with a fine file, then drill the holes for the screws. As these will fulfil the double purpose of fastening this part to the case, and also to hold the alarum hand, the holes must be drilled at regular intervals apart, so as to bring the hand midway between the hours on the dial. The hand can then be fixed to either of the screws, and will command in this position the time between any two hours on that side of the dial. For instance, when placed at half-past five as shown on the dial at Fig. 1, it can be shifted to the right so as to meet the hour hand at five o'clock, or at any time between this and six o'clock. If unscrewed from this position and placed between one and two o'clock, it will command any time between these two hours at which it may be fixed.

The alarum hand is shown full size at Fig. 3. It is made of a strip of thin brass, with a small hole at one end to receive the fixing screw and at the other end a pin of platinum wire. This may be of any gauge from No. 16 to No. 22, but it must only be long enough to engage the hour hand, and must be short enough to allow the minute hand to pass over the hand without touching the pin. The screws employed in fixing this hand should be the small flat-headed variety as shown at Fig. 4, obtainable from all dealers in clock materials. Connection is made between this hand and the battery by means of a piece of silk-covered wire, coming out through a fine hole made in the case close under the figure VII, and attached to the brass semicirclet by passing one end of the bared wire around the screw which holds this end of the brass to the case. The other end of the wire is, of course, made fast to a binding screw at the back of the clock, and a wire goes from this to the battery. When the hour hand of the clock comes around to the spot where the alarum hand is set, the two engage with each other, and contact is made between the battery and the bell through the clock. The bell will then go on ringing until the hour hand has swept the alarum hand along over the space which the latter commands (probably during one hour) unless the sleeper awakes and gets out of bed to switch off the bell. A switch for this purpose, shown at Figs. 13 and 14, is generally placed in circuit at some little distance from the bed of the sleeper, such as on the other side of the room, or outside the room door. When time alarums are fixed for servants, the bell is hung in the servants' bedroom, and the switch is placed on a wall or partition outside the master's bedroom door. The alarum can thus be set on going to bed, and the servant must come out of her room to switch off the bell in the morning. During the day, the alarum hand can be turned back out of sight under the frame of the glass door which protects the dial.

In the form of American clock shown at Fig. 5 a different arrangement is required, as there is not any woodwork to which the semicircle of brass can be fixed, and any insulating substance placed on the dial would disfigure it. The dial might be removed and the semicircle insulated from the back of the dial by strips of ebonite or gutta-percha, attached to it by means of short screws. Holes would then have to be drilled through the dial between each figure, near the outer circle, to receive the screws used in connecting the alarum hand with the semicircle beneath, and these holes must be bushed with ivory, ebonite, or bone, to insulate the screws from the metal dial. Few amateurs care to thus disfigure the clock face, and would prefer some other method of fitting up the alarum.

One such method is shown at Fig. 5, as attached to the clock, which is here shown with the door removed for our convenience. The front arrangement to go over the dial, for the purpose of a connector between the alarum hand and the battery, is made up of a lattice work of thin strips of metal, as shown at Fig. 6. To this, at the upper end, is riveted the alarum hand, shown at Fig. 3, whilst the lower end of the lattice is secured by a screw to the pillar, shown at Fig. 7, and this in turn is screwed into a piece of brass to form a bracket foot, as shown at Fig. 8, the whole being then fastened to the backboard of the clock case, immediately under the dial, as shown at Fig. 5. This arrangement will secure insulation of the alarum hand from the metal dial, and provide an elastic and sufficiently rigid arm capable of being elongated to reach the small hours, turned aside to bring the hand in position under the hours from 5 to 8, and shortened or folded up when not in use to place it out of sight during the daytime, when it would be covered by the opaque part of the door.

The lattice work is composed of several strips of thin sheet metal riveted together as shown; the metal may be thin, hard

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sheet brass or copper, or tinned sheet iron such as tin utensils are made of. The strips should be only $\frac{3}{16}$ in. in width and $1\frac{1}{8}$ in. in length, cut to the shape shown at Fig. 9, and drilled with three holes in each, as shown. The holes should be only large enough to admit brass toilet pins, and these will thus form excellent rivets, with one head already made. The strips must be firmly riveted together, as shown at Fig. 6, but a little play must be allowed to each joint, just enough to make each work stiffly, for if made too loose the arm will not be sufficiently rigid. The number of strips employed must be determined by the length of arm required, which will vary with the size of clock dial, and with the hours to be covered with the alarum hand. The two strips at top, to hold the alarum hand, and also the strips at the bottom to attach the lattice to its supporting pillar, must be shorter than the others, and should be shaped as shown at Fig. 10. The alarum hand should be riveted between the two top strips at the angle where they meet each other. The lower strips may be made larger or have their lower parts enlarged, as shown at Fig. 11, to receive holes suitable for attaching this part to the pillar by means of the screw, shown at Fig. 7. This pillar should be turned out of a piece of brass rod to size and shape of sketch, but the length must be determined by actual measurement on the clock in which it is to be employed, as it should just stand high enough to enable its arm to clear the face of the dial. The lower part of the pillar may be made in the form of a screwed tang, as shown, to screw into a brass foot, Fig. 8, or it may be soldered to the foot. The top part must have a $\frac{3}{16}$-in. hole drilled and tapped to receive the screw shown in the sketch, which must also be turned out of a bit of brass rod to the shape and size shown.

The various parts may now be put together and fixed in position. If the platinum pin on the alarum hand is found to be too long for the minute hand to clear it, the pin must be shortened. If the lattice arm works too freely the rivets must be tightened. If the enamel on the dial is a conductor of electricity, and the arm or hand touches the dial so as to close the circuit and ring the bell, varnish the under side of the lattice and hand with sealing wax, gutta-percha, india-rubber, shellac, or any good insulating varnish. Connect the various parts up to the line wire as directed in the first part of this paper. The brass ornamental pillars on top may be utilised here, or the wires may be carried to connectors such as those shown at Fig. 12 and already described.

I have given here instructions for adapting an electric time alarum to two different types of clocks, and these will suggest the means to be adopted for other larger or smaller ones of nearly the same type, including the old-fashioned kitchen clock. Almost any type of clock may be used by the exercise of a little ingenuity. If fitted with an ordinary striking alarum worked by means of cords and weights, the descending weight may be made to close the circuit of a relay, and throw an electric bell into action ere the alarum has done striking. For this purpose an action similar to that employed in Dale's Indicator Relay, recently described and illustrated in the articles on Burglar Alarums, will be required. A similar action may be employed with an alarum clock in a metal case. Attach one of the relay wires to the metal case of the clock, and the other wire to an insulated spring fixed to the back of the clock near to the T winding key of the alarum. At night arrange the insulated spring so as to come in contact with the T of the key, as this turns around when the alarum runs down; this will close the relay circuit and set the electric bell ringing. These are a few suggestions employed to stimulate the ingenuity of readers who may wish to make a time alarum. Should any difficulties present themselves to any persons wishing to adapt a clock to this purpose, if they will clearly state these to me, together with a rough sketch of the clock, I will endeavour to help them through the medium of "Shop."

HOME-MADE TOOLS.

BY J. H.

Straightedges and Winding Strips.

I now take another important section of tools—those, namely, which are used for the checking of the accuracy of work, and for lining out. In this article I will consider the straightedges and winding strips made in wood and in metal.

Wooden straightedges are, as a rule, employed by wood workers; metal straightedges by those who work in metal. Straightedges, surface plates, and squares are distinguished from other kinds of tools in this respect, that their accuracy can be best assured by constructing them without reference to any pre-existing standards, originating and completing them by a laborious process of trial and error. The fundamental principle is simple enough in itself, but the labour involved is both tedious and minute. The principle may be stated thus:—If three surfaces are mutually and interchangeably coincident, then each of those surfaces must be a true plane. It is impossible that it should be otherwise, and it is impossible that less than three surfaces will suffice by the test of their interchangeability to assure perfect accuracy. Thus, for example, suppose we have one straightedge with its edges planed parallel, and as true in the linear direction as we can get them when checked by the eye, or even by a more exact method still, by laying the straightedge down upon a plane surface—scribing a line along one edge, and then turning the straightedge over and placing its opposite edge beside the same line, when it may appear to coincide. But now, if we make another straightedge, the precise duplicate of the first, and then try edges to edges, we shall most certainly find that the light is visible between some portions, while others are in contact. There will be some amount of rounding and hollowing of the edges, which, however minute in quantity, is to that extent a departure from truth. And though we may alter and modify until we think we have coincidence between two edges when tested in succession by changing end for end, and although this amount of accuracy would be sufficiently approximate for the ordinary purposes of wood working, and also for much metal work, yet it cannot be absolutely accurate. For if a third straightedge be now made, the counterpart of the first two, then it will be seen on trial that the three will not be mutually interchangeable with one another. But by constructing three the coincidence can be made absolute. Thus it is clear that if the edges of straightedges Nos. 1 and 2 are coincident, it may happen that both are slightly inaccurate in opposite directions—that is, convex and concave. But trying the third against both No. 1 and No. 2, it will indicate whether any inaccuracy exists; because it is impossible that it should coincide with two other edges unless those edges are true. In this manner the least traces of inaccuracy may be detected and gradually reduced to an infinitesimal amount. But the same results may be obtained by making two *parallel* straightedges, and using these edges as a check upon each other. Thus, making two straightedges alike in width, with edges at precise right angles with their faces, calling their edges A and B, C and D, they may (Fig. 26), when A and B are brought edge to edge, have the relationship shown in that figure, the curvature being exaggerated of course for purposes of illustration. The trial of these edges alone, therefore, would tell us nothing, because, to all appearance, they coincide. But, reversing the edges they would have the appearance of Fig. 27; also exaggerated. Obviously now we have to reduce the concavity of one pair of edges, and the convexity of the other, in exactly equal proportions, until either edge when tried against the two edges of the other strip are so nearly coincident therewith that no difference can be detected by ordinary tests of wood workers, such as chalking the edges and laying them together. Practically and theoretically the strips are true.

Carpenters, joiners, pattern makers, and cabinet makers usually make their straightedges in pairs as "winding strips;" and it is clear that if two winding strips are in the first place parallel, and then coincident when the positions of edges and ends are changed, there is obtained really the contact of three edges, and as near an approach to accuracy is obtained as is possible or essential. If they are not made as parallel strips, but simply as single straightedges, then it is absolutely essential that *three* be made.

So much for the principle; now for the details. Take first wooden straightedges. They are usually made either of well-seasoned yellow pine or of straight-grained mahogany. No other woods are so suitable. Pine is used for straightedges many feet in length; mahogany for those under three feet.

First, rough out all the stuff, because strips of timber when newly cut out of the board, even though the board is thoroughly seasoned, are apt to curve and warp to a greater or less extent. This is especially the case with mahogany. Jack it over, and preferably let it stand by for a few days, or even weeks. Then plane to gauged thickness and gauged width, and square the ends. Screw the two pieces together side by side; or if screw holes are deemed unsightly, glue the two strips together with paper joints: that is, slips of paper interposed—say one slip near each end, and one about the middle, and glued between the strips. When the planing is done, the joint can be broken, the paper dividing through the middle of its thickness. Finish now the planing of the edges, using a trying plane sharpened very keenly and set very fine; gauge to width with a fine-toothed gauge; check with calipers also, and test for linear accuracy by means of the best straightedge available. If no such straightedge exists, then a trained eye is a good arbiter. Or, having planed one edge as true as possible, lay the straightedge down upon a board, scribe a fine line by that edge, and turn the strip over, bringing its opposite edge close up to the line, when any inaccuracy will make itself seen (Fig. 28), where it is exaggerated, the amount of inaccuracy being half that of the quantity of divergence. If the strips are of considerable length—say from four or five feet—turn

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them end for end, when perhaps something of the kind seen in Fig. 29, also exaggerated, will be apparent. Now the projecting portions of the strips, those which come in contact with the scribed lines, will have to be reduced, and at the same time the calipers must be in constant requisition to ensure that parallelism of the edges is secured; and the square must also be used, because the edges must be kept uniformly at right angles with the faces.

Having at last done to the best of our ability in getting the strips parallel and straight, unfasten them, and laying them edge to edge by opposite edges in succession, and then changing ends and trying opposite edges again, correct with the trying plane where necessary, still using calipers and square. Practically, most of the work will have been done during the period when the strips were united, and the less that is left to be done afterwards the better.

To preserve the wood from subsequent atmospheric influences, it is best to protect the broad faces and ends with an application of shellac varnish. This does not apply to the edges, because they usually have to be chalked. This chalking wears the edges hollow in course of time, and the wood is always apt to warp more or less. It is necessary, therefore, to re-correct winding strips and straightedges every few months.

To prevent wearing of the edges, due to frequent chalking, careful workmen often keep winding strips quite distinct from straightedges, using the former only for testing the amount of winding of stuff, and the latter for checking its transverse truth when planing it over. It is sometimes necessary to make a straightedge so long, or for so temporary a purpose, that it is not desirable to make a couple. Then very fair results may be obtained by laying the two edges in succession against a scribed line, as before described, and also by reversing end for end, and again trying against the line. The errors may be so effectually minimised in this manner as to leave very little to be desired. Another way is to lay the straightedge down upon its flat face, and to strain a chalk line along from end to end, keeping the line away from the edge by about ¾ or 1 in., with blocking. Then a gauged thickness strip, carefully tried between the line and edge at intervals, will reveal pretty accurately the condition of the edge. The line must be thin and of equal size, and strained very tightly. Then, for a single long straightedge, it affords a safe method. In the making of long wooden straightedges, very great help is derived from the employment of a true plane. A trying plane recently shot, and with its iron in good order, is a great help to correct results.

Taking next the metal straightedges: these are made of steel of moderate hardness, temper, and elasticity. A piece of steel may be thinned down by hammering and so used, but it is better to get a strip of the correct thickness at once. Large shop straightedges and strips are made of wrought iron; very large "master" straightedges are of cast iron, properly stiffened and ribbed. The straightedges to which my present remarks will have reference are those ranging from one to two feet in length, and made of steel plate from $\frac{1}{16}$ in. to $\frac{3}{16}$ in. in thickness. If the plate is not of the correct width, it will be roughly lined out. Centre-pop the outlines of the straightedge upon the steel as a guide for the first stage of cutting out, Fig. 30. Then, if thin, it may be cut round roughly with a cold chisel, or if so much as $\frac{1}{8}$ in. or $\frac{3}{16}$ in. thick, the best plan will be to drill a number of $\frac{1}{8}$-in. or $\frac{3}{16}$-in. holes in close contiguity alongside the lines where the plate has to be divided. If the steel is too hard to stand drilling, it is too hard for a straightedge, and its temper must be lowered, and the metal be annealed to give it equal elasticity throughout.

The edges will now be roughly and approximately filed or ground to width and length. By the time this cutting off and roughing out are done, it is certain that the plate, even if true originally, will no longer be so. Hence, before going into any further details of filing and finishing, the sides must be brought into linear accuracy and perfectly free from winding and unevenness. Probably they may have to be hammered more or less upon a block of iron, or of hard wood set end grain upwards.

The use of a surface plate would be desirable at this stage for the purpose of testing the accuracy of the faces. Failing that, a true lathe bed will answer the purpose. When hammered, draw-filing will have to be resorted to, in order to obliterate the hammer marks; and to ensure reduction to accuracy, bedding on the lathe bed or surface plate will be adopted as a test. During filing, the strip of steel will be laid upon a block of wood, and held steadily between nails driven in around the edges, the wood being clamped in the vice jaws.

The straightedges can be filed now either singly, or both at one time if desired, being united with a particle or two of solder. It will be of much assistance if a light cut can be taken down the edges in a planing machine; but if not, then the next best thing is to use a surface plate or lathe bed as a guide in giving the initial edges to the strips. If the plate or bed is accurate, and the strips are brought into parallelism with calipers, there will be little left to be done afterwards in the way of alteration and correction. But the difficulty of truing up strips is very much increased with every increase in length and in thickness. So that if we have straightedges of metal 2 ft. long and $\frac{3}{16}$ in. thick, they will give us much more trouble than strips 1 ft. long and $\frac{1}{16}$ in. thick. It is difficult to hold the file so that the edge shall be at perfect right angles with the faces, but then allowing the edge to be slightly bevelled in any one section involves a reduction of the edges of each strip to that diminished width. Hence, when we get to the later stages of fitting of the strips, the way to check them together is to lay them side by side and edge to edge on a surface known to be true, and to check the contact of edges in the vertical as well as in the longitudinal direction, and in this way the square will be assisted. During the later stage of fitting, after having used the file until it will no longer afford that localisation of action which is required, we resort to the scrape; and in this way we are able to remove very minute quantities of material. To guide us in localising the action of the file and scrape, a very thin paste of red lead and oil will be smeared along the edge from which we want to transfer contact. At the final stages this must be very thin; in fact, wiping the edge with an oily wiper will suffice. Beyond this, the checking of the various edges until absolute interchangeability is secured will be done precisely as in the case of the wooden straightedge already described.

If any old and experienced hand is inclined to urge that he knows all about the management and manipulation of straightedges, and that it would be difficult for me to tell him anything that he does not know already, let me remind him that it is not for him that I am writing, but for young apprentices whose experience is little more than *nil*, and for workmen who are willing to learn and not above being told.

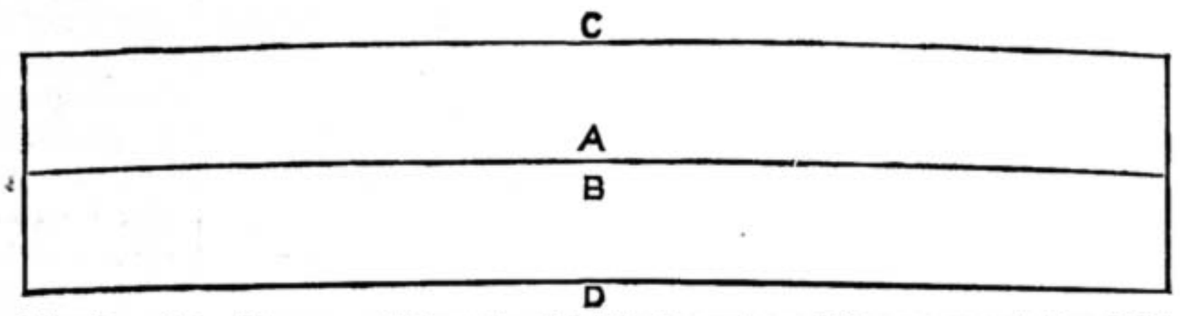

Fig. 26.—Coincidences of Two Parallel Strips whose Edges are not Straight.

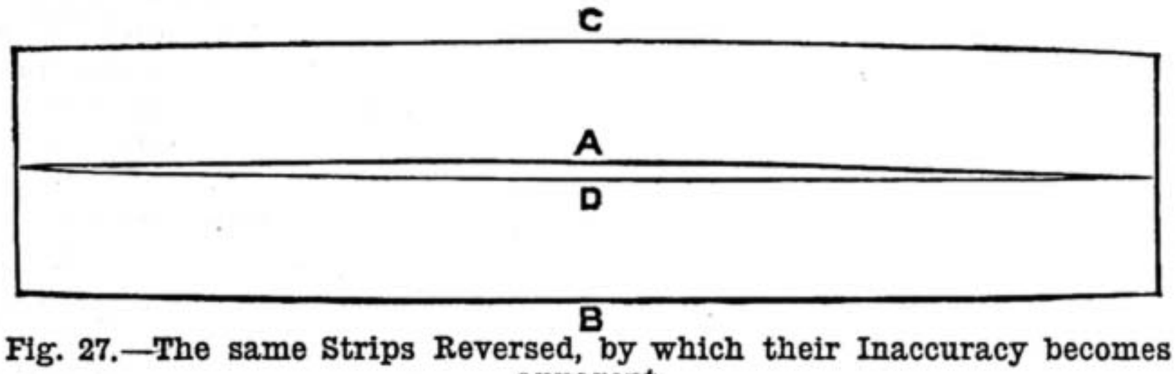

Fig. 27.—The same Strips Reversed, by which their Inaccuracy becomes apparent.

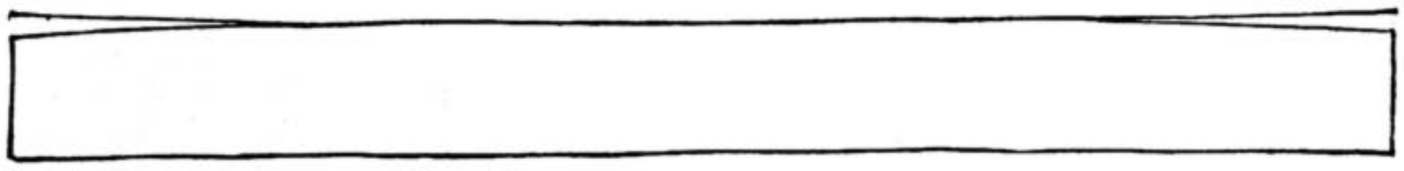

Fig. 28.—Trying a Straightedge against a Line marked from its own Edge.

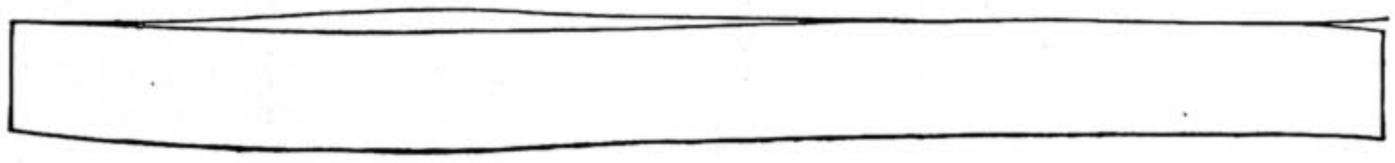

Fig. 29.—Another Example of Trial of Straightedge against Line marked from own Edge.

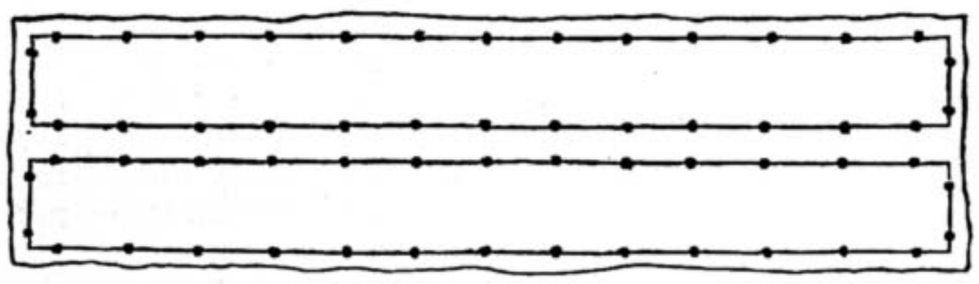

Fig. 30.—Winding Strips Lined out and Centre-popped on piece of Steel Plate.

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HOW TO MAKE A PIANO.

BY "NIL DESPERANDUM."

THE SOUND-BOARD—ITS CONSTRUCTION AND PREPARATION—HOW THE BRIDGES ARE MADE—FITTING TO THE BACK.

IN my first paper I spoke of the back as being the foundation of the piano. From the foundation we take the next step forward, that is, to the sound-board. While the back is firm and rigid, the sound-board is vibrating and sensitive, so that we have the two extremes. If you look at the interior of a piano, you will see that the sound-board lies immediately behind the strings; it covers the back within the wrest plank and bent side. It is technically named the belly. I suppose the person who named the parts of a piano must have had the names of the parts of the human frame in his mind, for in the piano we have the back, belly, cheeks, legs, feet, and toes. The sound-board fills a very important position in the piano, for without it you would only get the tone of the wire, which would be very poor and weak in itself, as can easily be proved by stretching the string over any rigid surface. When the string is struck with the hammer, the sound is transmitted from the bridge on which the string rests to the sound-board, which takes up the sound waves, and increases the power of the vibrations; so that when a person is playing the piano, the sound-board is in one continual vibration. If you strike a tuning fork on the prongs, and the end is placed on a solid block, very little sound is emitted; but if struck when placed on the panel of a door, its tone is intensified. To show how wood is a conductor of sound, let the reader get a friend to strike a tuning fork on one end of a plank, no matter what length, and he will distinctly hear it at the other end.

I knew a man who was very deaf—so deaf that you had to write on a slate what you wished him to understand; he had a square piano, and he used to sit playing with the bowl of his pipe resting on the sound-board, and the stem between his teeth, and by that means he was enabled to enjoy his own, or any other person's, playing; the pipe in this case was the conductor. If you take a common fire poker, and tie a piece of string about half a yard long round the head of the poker in the middle of the string's length, then twine the two ends round the forefinger of each hand, place them in the ears, and, bending the head forward, give the poker a swinging motion, and let it strike any object, you will have a splendid imitation of church bells, the string conducting the vibrations to the ear.

I will now endeavour to instruct the reader as simply as possible as to the making of the sound-board. It is usually made from Swiss pine, but can also be made of American pine, or spruce, about ½ inch in thickness, free from knots and shakes, and thoroughly dry. Most timber merchants keep dry material. Having selected the wood, lay the back on the trestles with the plank and bent side uppermost. You will probably find your boards unsound at the extreme ends; if so, cut them off, as it is better to reject them at first than to have trouble with them afterwards. Now lay the boards on your back and cut your first length off; let it run parallel with the wrest plank, and overlap each side of the back ½ an inch, the first board put under the bottom edge of the wrest plank. Now take the remaining boards in rotation, and put together edge to edge; of course, they will decrease in length as you get to the bottom; let them first overlap the rebate of the bent side, so that you have a little to work on. Having done this, make two lines across the whole of the boards in the shape of the letter V, so that you will know their position. Now turn the back over with the wrest plank on the trestles. The reader will probably think there is a lot of turning over; the reason is, that in a factory they have a large board for jointing the belly on, and I want the reader to utilise the back for the same purpose. You will find that your back has two strips of wood across the top and the bottom. Now these will be found useful in jointing your sound-board. Shoot one edge of your first board, and after laying a sheet of paper to keep the back clean, place the board up to the slip of wood mentioned above; put a handscrew on each end to keep it in position; now shoot the edges of the remaining boards, and try to make as good joints as possible. Having jointed them all, get a piece of wood about a ¼ inch wider than the intervening space between the bottom edge of the sound-board and the bottom slip, then having made your glue hot and thin for jointing, warm the edges of your wood well, and glue edge to edge on the back, rubbing each joint till you find it bite, then place your slip of wood in, being a quarter of an inch wider than the space; your belly will bulge in the centre. Now by placing a board on the top, and some weight, it will make your joints go up close. While this is drying you may get out your bars; these are made of ¾-in. spruce ½ in. wide; these are placed across the sound-board in a vertical direction, one between each bracing, so that you will require eight of them. Plane over the sides after you have cut them out and straighten one edge, and make the other edge a ¼ in. round in the centre, graduating to the points; on this edge use the toothing plane, or scratch it with your saw, as this edge has to be glued, and it makes it hold better. When your sound-board is dry you can take it up and remove any superfluous glue that remains with a chisel. Then proceed to plane it over; you can do this while it is on the back, by moving the handscrews to where you are not planing; after planing over one side pretty level, which you can ascertain by rubbing your hand over, then gauge it round from that side about ¼ in. in thickness all round, leaving it a

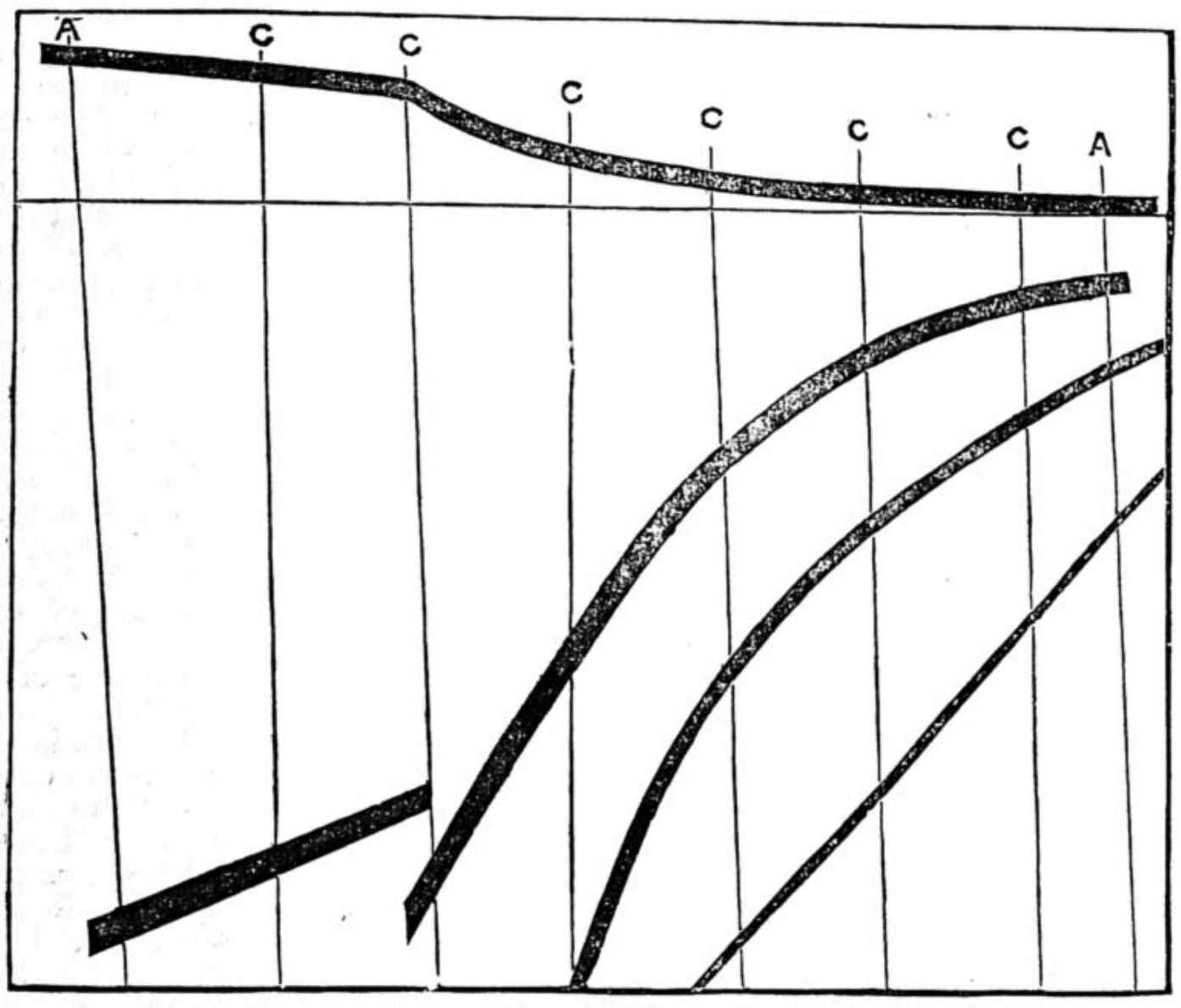

Fig. 1.—Diagram showing Plan of Bridges. (Scale, 1 inch to 1 foot.)

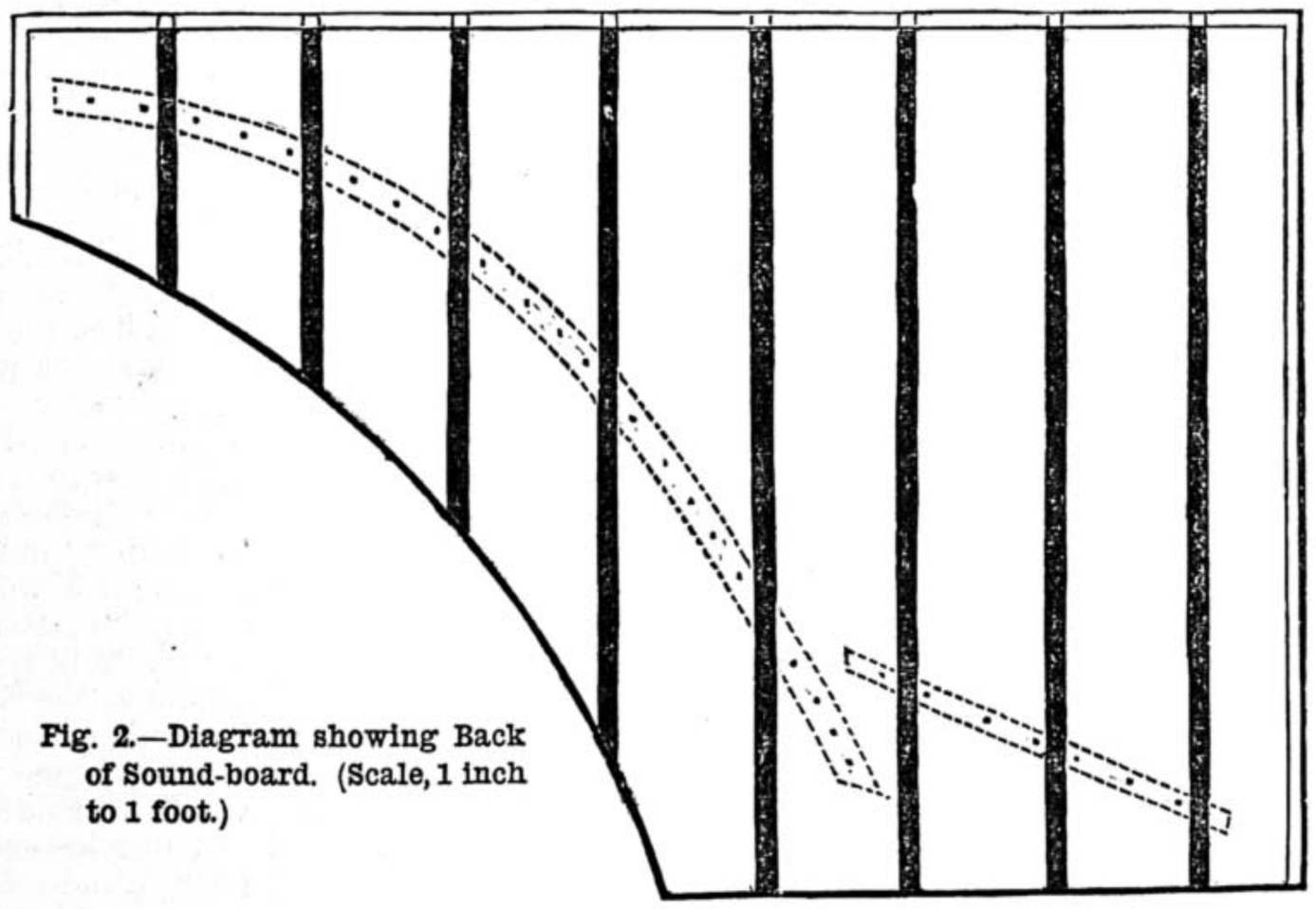

Fig. 2.—Diagram showing Back of Sound-board. (Scale, 1 inch to 1 foot.)

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trifle thicker at the treble end, also at the bass bottom edge.

Now take a piece of chalk and rub it round the edge of the bent side, and lay your sound-board in its place, which will be a ¼ in. below the wrest plank; you can put two pieces of wood on the bottom edge temporarily, about ½ in. long. Now press your sound-board on the chalk line, and that will give you the mark to cut it out, so that it fits in. Having fitted it, you stand the back on its bottom; make a mark with pencil each side of the bracings, and between these marks will be the place for each bar before mentioned. The method of putting these on is by springing a bar a little longer than the distance between the bar and a board or ceiling above, which consequently gives a downward pressure; but it can also be done by gluing one bar in its place at the back, and using another at the front, which must not be glued; for giving pressure, put a handscrew each end of the bars, the round edges to the sound-board.

Before gluing, see that it brings it to a joint; have your glue rather thin and your bars hot. Serve the remainder in the same way. When you have got the bars on, make a line across the top and bottom of them 4 in. from each end; from this point they must be bevelled down to ⅜ in. from the sound-board, except the bass ones that do not touch the bent side; leave these ¾ in. thick at the bottom ends. Now you will have to put fillets on three edges of your belly; these will be of pine 1 in. wide and ¾ in. thick for the top and treble one, and 1 in. square for the bass one, graduating it from 1 in. in the centre to ¾ in. each end; the top fillet is cut out to fit over the bars at the edge, and these are then glued on; of course, the treble one will just fit the space between the wrest plank and bent side. The sound-board rests on these slips and on the rebate of the bent side.

By reference to diagram you will ascertain the length and shape of the bridges. They are made from beech 1¼ in. wide, except the top bridge, which is 1 in. wide and ½ in. thick. When you get your bent side and wrest plank, if you order two wrest planks, one will make your bridges. You cut one edge out to the shape of your long bridge, then gauge it 1¼ in. wide from the edge; you will be able to cut out all your bridges from one plank with a little care, cutting up the straight part with a hand saw, and the curves with a frame saw. For the top bridges be careful to keep the flowery side of the wood uppermost; you will see this by observation.

Having planed your bridges, and prepared them for gluing, you can clean any superfluous glue from the back of your sound-board, then take some coarse glasspaper and clean it. Now you will require a pint of white hard varnish; varnish the back twice over, except the fillets and bent side edge, as the glue will not stick to the varnish. Now you must put the sound-board in temporarily, and mark for the long and short bridges, and ⅛ in. below this line prick through the belly about every two inches with a small bradawl; this is needed when you are putting on your belly bridges. Now get some ¾-in. screws ready, and your glue hot and not too thick, so that it will run nicely from the brush; warm your long bridge and glue; put a handscrew on at the treble end, and where you can get others on from the hollow edge; then drive the screws in the holes you have made as quickly as possible from behind; serve the short bridge in the same way.

Now you will want a bottom plate; one made in cast iron for 47 notes will suit you best, and be the easiest fitted. It has three projections on as a rule, with screw holes in, and the bottom of the plate has holes for bolts; the treble end rests on the end of bent side, and the first bass note will be 4½ in. from the outside of the back; this plate must be fitted level. You can bore the holes for the screws through the projections, so that it will go in the same place, as you will want it out to put the belly in. To put the screws in after the belly is in, you must bore centrebit holes through the belly above those previously made. I may mention here that all the ironmongery that is required for the piano may be had from W. Hughes & Co., 37, Drury Lane, W.C.

Now your sound-board is ready to be put in its place. Round the edges bore holes for 1-in. screws for the top and treble and round the hollow edge, and for 1½-in. screws at the bass edge. It would be better to have the assistance of a friend at this stage to help you to glue your sound-board in. Have your glue ready and the screws through the sound-board half way. Warm the edges of the sound-board, and glue all edges except the bottom. Now, as quickly as possible, turn all the screws in their place.

To ascertain the shape of your bridges and their position on the sound-board, you will find by reference to diagram that the bottom edge of the wrest plank is used as a basis for calculating the length of the strings; for this reason it is called the strike line, as the hammers strike the strings at this point. The first note is A, which is 2½ in. from the treble end on the strike line. The first C will be 7⅜ in.; make a mark at these points. Second C, 13¾ in.; third C, 20⅛ in.; fourth C, 26½ in.; fifth C, 33 in.; sixth C, 39⅜ in. The last note, which is A, is 47½ in. Take particular care with these measurements, which are all on the strike line, measured from the treble or right-hand side of your back. From the same side at the bottom mark one point 1 in.; second one, 5½ in.; third, 12¼ in.; fourth, 18⅜ in.; fifth, 25⅜ in.; sixth, 31⅞ in.; seventh, 38⅜ in.; and the last, 45¼ in.

It would perhaps be easier for the reader if he were to have a sheet of white paper the size of the back, and measure the width of his wrest plank and make a line for strike line. Having made these points, get a straightedge, and make lines from top to bottom intersecting these points.

Now I will give distances above the strike line for the shape of top bridge. The first note, A, runs level with the bottom edge of plank. First C, $\frac{3}{16}$ in.; second C, ⅜ in.; third C, 1 in.; fourth C, 2¼ in.; fifth C, 3⅞ in.; sixth C, 4¾ in.; last note, A, 5½ in. Now for the distances below the strike line for the shape and position of the belly bridge. First note, A, 2¼ in. First C, 3⅛ in.; second C, 5½ in.; third C, 10½ in.; fourth C, 19¼ in.; fifth C, 28½ in.—this is the last note on the long bridge. The first note on the short bridge is B, which is 25½ in.; then A, the last, 30½ in.; this bridge is straight and 15½ in. long. On the wrest plank the bridge is placed above the line, while on the sound-board the bridges are placed below the line.

You will see by reference to diagram how these lines are used. Fig. 1 shows the method of obtaining the shape and position of bridges. Fig. 2 shows back of sound-board, the dark lines being the bars and the light double lines slips on the edge.

PRACTICAL HINTS ON MOUNTING OBJECTS FOR THE MICROSCOPE.

BY A. T. SMITH.

TRANSPARENT OBJECTS — PREPARATION — MOUNTING MEDIA—MOUNTING IN CANADA BALSAM—AIR-BUBBLES.

My last article dealt principally with the mounting of opaque objects by the dry method, and we may now, I think, proceed to the second part of our subject, namely, mounting transparent objects for examination by transmitted light.

Objects the most divergent, and, at first sight, quite the reverse of transparent, come under this heading, and by careful preparation can be made sufficiently translucent to enable us to make out the most minute details of their structure. Take, for instance, a piece of coal; who would suppose that anything could be made out of this but the shapeless black mass it appears to be? Yet, by carefully grinding it down to a suitable thickness, it can be made transparent, and its structure can be as clearly defined as the surface of a butterfly's wing.

The different operations involved in the process of preparation of transparent objects are cleaning, hardening, section cutting, staining, and injecting, and it is in these branches of our work that delicacy of manipulation, and, in addition, care in the choice of mounting media, are most essential.

The words "mounting media" in the last sentence at once suggest the primary difference between the operations of mounting opaque and transparent objects. In mounting the former, as we know, the object is simply enclosed in its natural state in a dry air-tight cell, but in the latter case the object requires almost invariably to be mounted in some transparent preservative medium which will permeate its tissues, and, to a certain extent, render the object itself more transparent by increasing its refractive power. The media principally used for this purpose are Canada balsam, gum dammar, and glycerine, with various modifications which will be referred to later.

Since, in order to make a successful mount, it may be necessary to make use of all or any of the processes of preparation referred to above, we will define them briefly before going any further, and leave the more detailed consideration of each particular operation to a future opportunity.

Our dictionary will tell us that the word "cleaning" indicates the action of removing dirt, and a well-known writer has defined dirt as "matter in the wrong place." This definition of dirt suits us exactly, for, from a microscopical point of view, the process of "cleaning" includes the removal of various matters from animal and vegetable tissues, which can hardly be defined as dirt pure and simple—natural oils, fatty and muscular tissues, and colouring matters, for instance.

Some objects are so soft and flaccid in their natural state that they have to be hardened before they can be cut into sections or mounted, and, on the other hand, some objects are already too hard and brittle for our purpose, so that our attention has to be directed to making them soft.

Hardening re-agents are alcohol, turpentine, Canada balsam, oil of cloves, bichromate of potash, and picric acid; and for softening, glycerine, carbolic acid, or a weak solution of caustic potash or soda may be used.

Section cutting involves the art of cutting a section or shaving from a large object

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sufficiently thin to become practically transparent when soaked in a liquid medium.

Staining consists in colouring the sections, which may at times be *too* transparent, with suitable dyes and re-agents, so as to bring out in strong detail various points in the structure of the object which before were almost invisible.

Finally, injecting indicates the operation of forcing colouring matter into the minute capillary vessels of an object in order to render them distinctly visible.

And now as to the choice of mounting media.

Canada balsam is the microscopist's oldest friend, and when the object will stand the rough usage necessary to adapt it for mounting in this medium, it is the best one to use, because once well mounted in Canada balsam an object may be looked upon as settled for life, for the older it gets the better it looks, and there need be no fear of leakage.

Canada balsam as sold by the druggist is hardly suited for our purpose, as it would take too long to harden. For this reason, a portion should be placed for a short time in an open vessel in a moderately warm oven, care being taken to exclude every particle of dust. By this means the volatile spirit in it will be driven off, and eventually the balsam will become almost brittle. In this state a few pieces should be taken and dissolved in chloroform, and the whole kept in a wide-mouthed stoppered bottle for use. A bottle like Fig. 1 is the best form to use, because the balsam does not run down the outside, and the stopper is not liable to stick as in the case of an ordinary bottle.

The most suitable objects for mounting in Canada balsam are animal sections stained and, or injected, sections of timber and mineral sections, portions of the hard coverings of insects (Coleoptera and Diptera), diatoms, etc.

Gum dammar may be used for the same class of objects, and should be prepared for use by being dissolved in benzine. It is, in some respects, not quite so useful as Canada balsam, being more brittle and liable to crack, though, on the other hand, it is almost entirely free from the objectionable yellow colour of Canada balsam.

Fig. 1.—Bottle for Canada Balsam.

But I must confess that, for my own part, I much prefer glycerine as a mounting medium with or without modification. My reasons for this preference are—first, because it may be diluted with water to any extent, and, as a rule, will assimilate readily with most animal and vegetable secretions, and thus permit the mounting of an object in as natural a state as possible. This is a great desideratum, and, further, it is absolutely colourless.

The great difficulty with glycerine and its compounds is to prevent it leaking from under the cover glass or out of the cell. It has such an affinity for water and such a strong solvent power, that it is difficult to make a really good permanent mount which can be guaranteed not to leak.

Glycerine jelly is sometimes used for mounting vegetable tissues, and may be made as follows :—Take a small quantity of gelatine, and allow it to soak in cold water for two or three hours, then pour off the superfluous water and heat the gelatine gently until it melts. To each fluid ounce of the gelatine add one drachm of alcohol, and mix well; then add, in the same way, a fluid drachm of the white of an egg, and boil the whole mass until the albumen coagulates. Now strain through a piece of flannel, and to each fluid ounce of the clarified gelatine add six fluid drachms of pure glycerine and mix; a few drops of pure carbolic acid should now be added and the whole put into a bottle and allowed to cool. When required for use, the jelly should be melted by immersing the bottle in warm water, and it is as well to warm the slide and cover glass before mounting. I do not recommend glycerine jelly for delicate work, on account of the necessity for the employment of heat in mounting.

Farrant's solution is an exceedingly useful medium for mounting animal and vegetable sections and dissections, but for the latter I always prefer glycerine, either pure or diluted with water and with the addition of a few drops of pure carbolic acid to prevent decay and the appearance of *fungi*. The following is the receipt for Farrant's solution, according to Dr. Carpenter. Dissolve four parts by weight of picked gum arabic in four parts of cold distilled water, and add two parts of glycerine. The solution must be made without the aid of heat, the mixture being occasionally stirred, but not shaken, whilst it is proceeding. When the gum is dissolved, the liquid should be strained (if not perfectly free from impurities) through fine cambric previously well washed out by a current of clean cold water, and it should be kept in a stoppered bottle containing a small piece of camphor.

Some microscopists prefer to filter the solution of gum through fine blotting-paper in a damp chamber and to mix it with the glycerine after straining. This is, perhaps, the best plan, and it certainly gives more satisfactory results. The great advantage of this medium over glycerine jelly is that it can be used cold.

Suppose, now, that we wish to mount a portion of an insect—say the leg of a housefly or of a beetle—in Canada balsam. Select a glass slip and cover glass, and, placing the object in a drop of water in the centre of the slide, apply the cover glass gently, and examine with the microscope; we see a densely-black unlovely object, with a number of bristles sticking out of the sides. But now, take the object and soak it for a few hours in a solution of caustic potash or soda, or gently warm it in the same, and a change will come over the scene. Remove all traces of the alkali by washing the object in clean water, and examine again. The black colour will have vanished, and you will see in its stead a delicately-coloured, transparent, brown, horny structure, its surface covered with hairs, and beneath the surface traces of muscular tissue distinguished by minute cross lines.

If there are any particles of dust adhering to the surface remove them by gently brushing the object in water with a camel's hair brush, and then, in order to expel the water, which will not mix with the balsam, immerse the object in alcohol. The alcohol labours under the same disadvantage as the water with regard to the balsam, but it will mix with oil of cloves, which, in its turn, will mix with the balsam. Remove the object from the spirit to the oil of cloves, and leave it to soak there for a few minutes until a slide is prepared.

After thoroughly cleaning a slide, warm it gently over a spirit lamp, and with a pointed glass rod place in the centre a drop of the prepared Canada balsam containing no air-bubbles. With a dissecting needle remove the object from the oil of cloves, and place it gently in the drop of balsam. Take a clean cover glass, and warming it also, place it gently on the top of the whole, as in Fig. 2. Resting one edge of the cover against the points of your tweezers, support the other with your dissecting needle in the manner shown. As the cover glass is

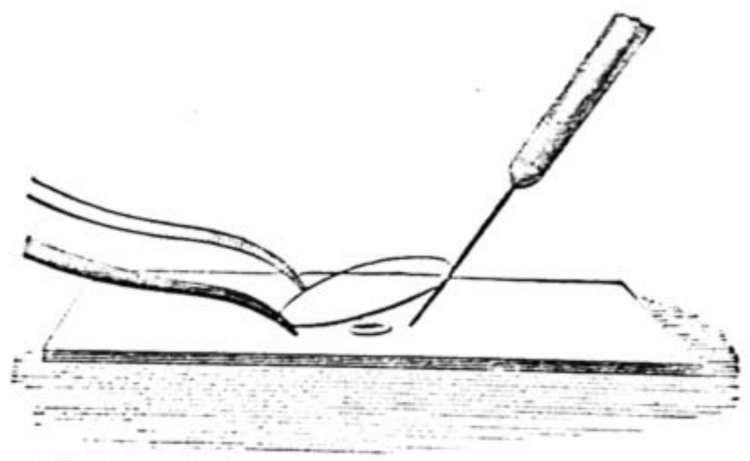

Fig. 2.—Mode of Mounting Object on Slide.

lowered by withdrawing the dissecting needle, the balsam should fill up the space between the centre and the edge of the cover glass, but if it does not do so, apply another drop to the edge and it will at once run in.

If examined now, the object will be seen to be brilliantly clear, and all the points of its structure distinctly visible. The slide should now be put aside in a warm dry place for a day or two, in order to allow the balsam to harden, and if there is any superfluous balsam at the edges of the cover it should then be carefully removed with the help of a rag and a little benzine, left again for a day or two, and then ringed with varnish, when it may be finished off and labelled in the usual manner.

It is necessary to exercise great care in lowering the cover glass on to the balsam in order to avoid the introduction of air-bubbles, but if, in spite of all your care, you find you have accidentally entrapped one of these little nuisances, you can generally manage to induce it to find its way to the edge of the cover glass by pressing the top with a clean dissecting needle. When you have got the bubble outside, the best plan is to bring its existence to an abrupt termination by pricking it with a hot needle, because, if left to themselves, air-bubbles generally die hard, and have a nasty habit of intruding themselves again and again in the places from which they have been expelled.

ON SOLDERING JOINTS IN METAL PIPE.

WITH SOME REMARKS ON BLOWPIPES.

BY R. ALEXANDER.

IMPORTANCE OF THE BLOWPIPE—HOW TO MAKE JOINTS—RESIN AND GREASE—VARIOUS FORMS OF JOINTS — UPRIGHT JOINT — HORIZONTAL JOINT—T-JOINT—SOLDERING WITH BLOWPIPE — BENZOLINE BLOWPIPE — GAS BLOWPIPE — SELF-ACTING BLOWPIPES OR BLOWLAMPS — FRENCH PATENT BLOWING LAMP—REGULATING FLAME TORCH BLOWING LAMP — PAQUELIN LAMP.

THE jointing and soldering of metal pipes, tin, composition (termed compo for shortness), and lead pipes, will next occupy our attention. Joints in pipes may be soldered with either the iron or the blowpipe: many people imagine that it is very difficult to

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solder with a blowpipe, but it is not so, when one has got over the awkwardness that is natural to a beginner in anything. One finds that to work with the blowpipe is as easy as with the copper bit, and it is very essential to a workman to be able to use the blowpipe, for it often happens, in doing a job of gas-fitting, that a fire cannot be had, and, even if it could, joints sometimes have to be made in very awkward places, near the ceiling, between joists, and many other places, where to use the soldering iron is very awkward, and sometimes even impossible. Then the blowpipe comes into requisition, and gets over the difficulty, as the worker will find, easily enough. Sprinkle a little powdered resin on it, and it is ready for soldering.

The handiest and best way of applying the resin is by means of a resin box, Fig. 9. It is a little tin or zinc canister, about 2½ in. high by 2 in. diameter, with a conical top that is removable, and a nozzle that is about 2 in. long and a little less than ⅛ of an inch aperture at the end. This box is filled with powdered resin, and is the best and cleanest way to carry resin about; a lump of resin thrown loose in the basket, as is often the case, soon crumbles up, and makes all the tools sticky, and wastes the resin as well.

Joints can be soldered with resin alone, or with tallow alone, or even with weak

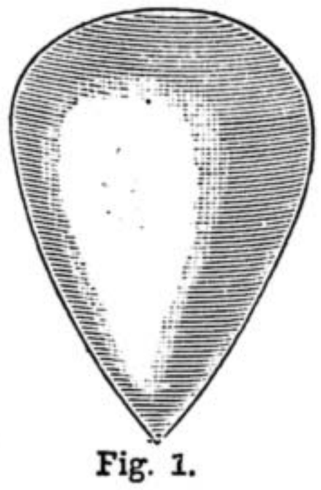


Fig. 1.

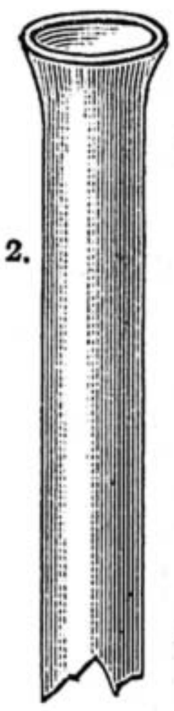


Fig 2.

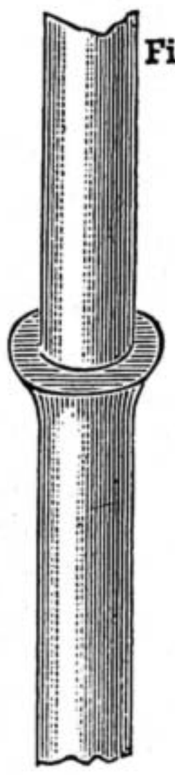
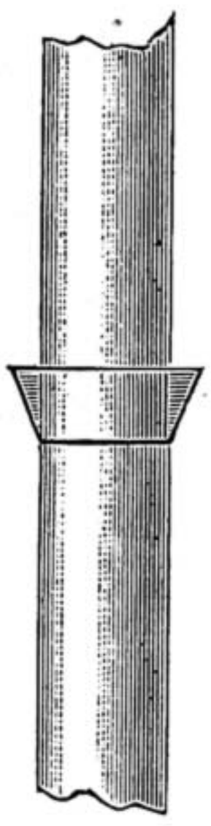


Fig. 3.

Fig. 4.



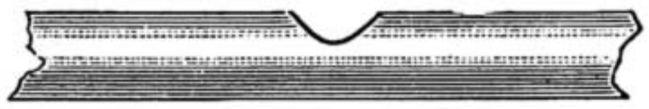


Fig. 7.

Fig. 5.

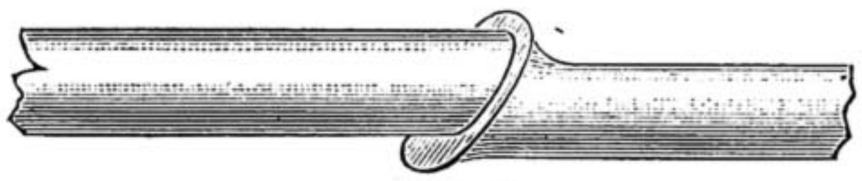


Fig. 6.

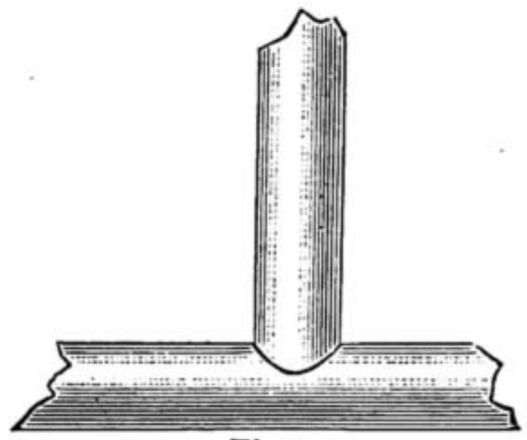


Fig. 8.

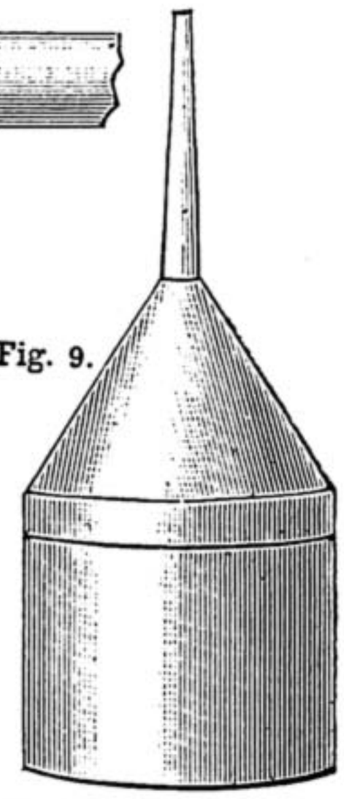


Fig. 9.

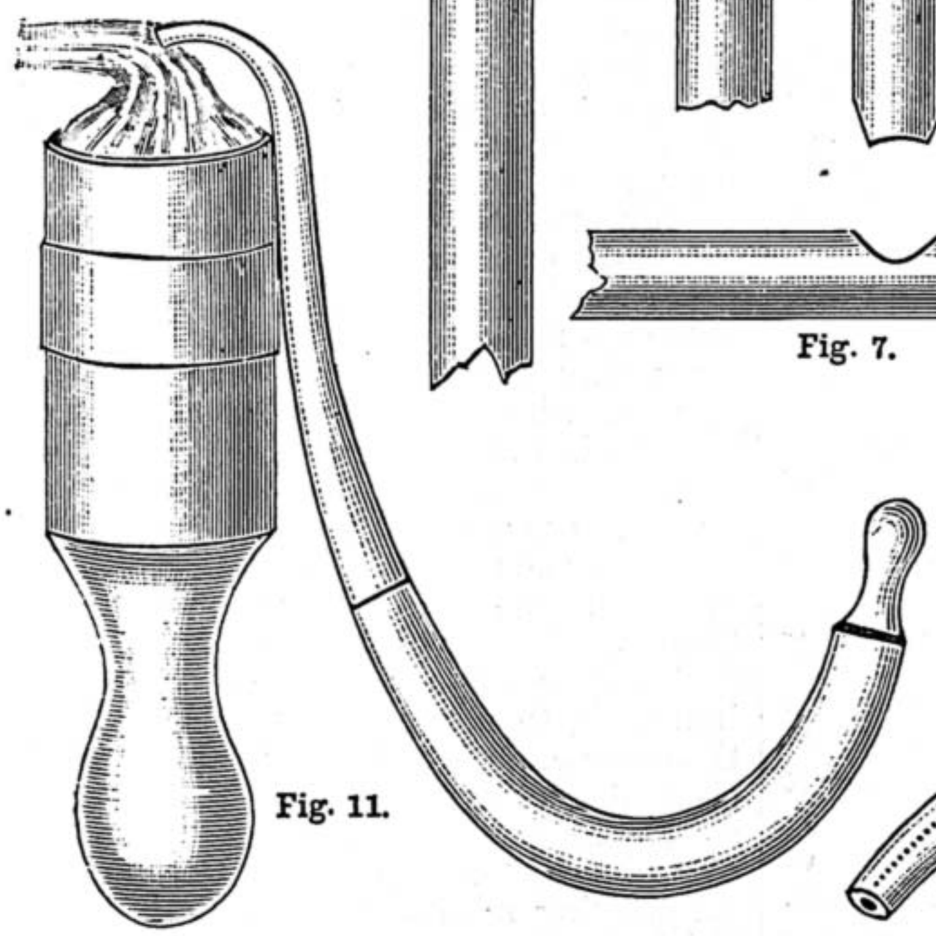


Fig. 11.

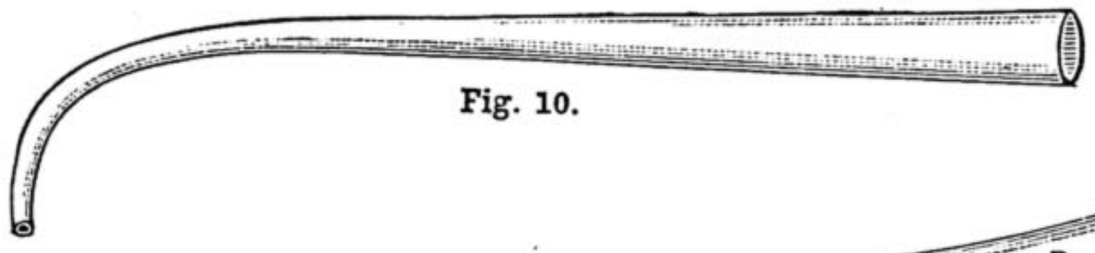


Fig. 10.

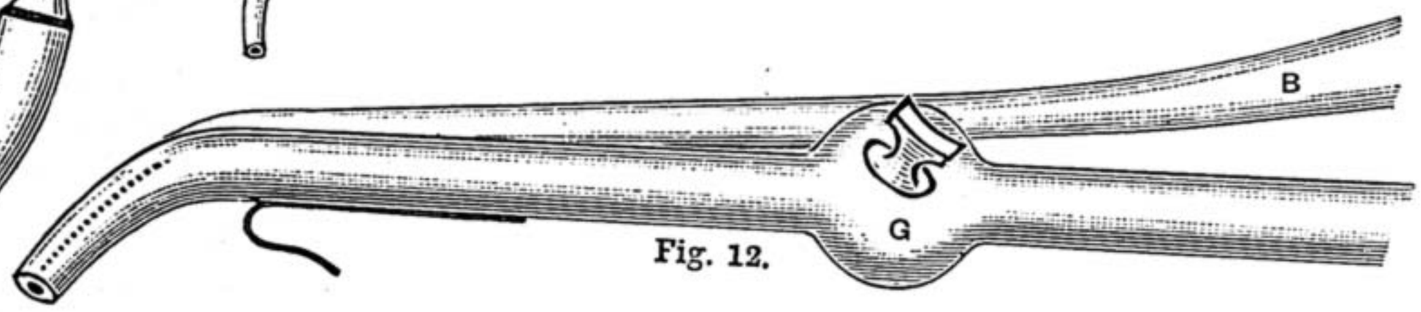


Fig. 12.

Fig. 1.—Tampion or Pipe Opener. Fig. 2.—Upright Joint Prepared. Fig. 3.—Ditto Soldered. Fig. 4.—Ditto in Section. Fig. 5.—Horizontal Joint Prepared. Fig. 6.—Ditto Soldered. Fig. 7.—T-Joint Prepared. Fig. 8.—Ditto Soldered. Fig. 9.—Resin Box. Fig. 10.—Blowpipe. Fig. 11.—Benzoline Blowpipe. Fig. 12.—Gas Blowpipe.

It is often a subject of discussion amongst workmen as to which makes the strongest joint, the blowpipe or the iron. My own opinion on the matter is this: That where circumstances are favourable, one is as good as the other, but in awkward places the blowpipe has two to one in its favour, and is far more likely to make a sound joint.

To describe the method of making joints, Fig. 1 is a tampion or pipe opener. This is inserted in the end of one of the pipes to be joined, and the pipe and that held loosely in the left hand and rapped with a hammer or mallet till the end is large enough to admit the other pipe. The inside of the part that has been swelled out (Fig. 2) must be scraped clean and bright; also the outside of the piece that is to be inserted in it. Rub a little tallow round the two cleaned surfaces, and place the joint in position. spirits, but I think the resin and grease the best; still, it is as well to know that either can be dispensed with on a pinch. Before proceeding with the soldering part, I will just briefly describe the other joints illustrated. Fig. 2 shows the joint I have been describing prepared. Fig. 3 shows it soldered. Fig. 4 shows a section of it cut longitudinally, showing how the solder has run round it. Fig. 5 shows a method of making a horizontal joint, a kind that often occurs in gas-fitting between joists and along walls. You will notice that one piece is cut slanting; this gives the solder a better chance to flow underneath the other piece than if both were cut square across, the same as Fig. 2. A horizontal joint prepared like this is no longer a difficulty. (For a handy appliance to hold joints, see "Our Guide to Good Things" in this number.) Figs. 7 and 8 show a T joint. The horizontally placed piece has a hole cut in it slightly smaller than the outside diameter of the pipe that forms the T. This upright piece is drawn in a little, and also hollowed out a little on two sides, so as not to obstruct the passage of whatever may have to pass through. It is then pressed into the hole cut to receive it; if it goes in too far a little must be cut off the end.

Now for the soldering part of the process. There are numerous blowpipes and ways of using them. A simple plan, and one much used by gas-fitters, is the ordinary blowpipe, Fig. 10, and a large-sized tallow candle or a bundle of rushes, such as are used for the wicks of rushlight candles. These are procured at the tallow chandler's; they are the rushes that have had one dip in the tallow vat. The best way to use them is not to wrap them up in a piece of brown paper as I have seen men do, but get a piece of ⅞-in. brass tube a foot long, turn a cap to fit on the bottom tightly, and one for the top not so tight, about 3 in. long. Take enough rushes to comfortably fill the tube and slide, easily push them into the tube, allow about half an inch to project out of the superfluous ends, and slip on the bottom cap.

Now take a strip of blowpipe solder in one hand, the lighted rushes or candle in the other (you must get accustomed to use either hand for either purpose), fix the blowpipe between the teeth, and, bringing the flame close to it, try to blow a pointed flame out of the side of it; you will probably find it rather difficult to keep the flame and blowpipe in correct "juxtaposition," as I may be

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allowed to say, but you will soon get used to it. Warm round the joint a little, also warm the end of your strip of solder, and just dip the tip of it in a little resin. Then hold the solder to the joint, blow on it, and gently rub it round as it flows under the heat from the blowpipe. Do not blow too long in one place, or the pipe itself may melt, and when the solder has flowed round nicely, cease blowing. Care must be taken not to stop up the pipe, especially very small tubes, such as used for pneumatic bells, for instance.

As the blowpipe just used, or supposed to have been used, is only about 9 in. long, it will be seen that the head and eyes have to be very close to the work, which is sometimes rather awkward. Fig. 11 is another kind of blowpipe which is also much used, and has some good features about it. It has some advantages over the one previously mentioned. The head can be moved about without disturbing the blowing; also, the blowpipe, being fixed to the lamp, is always in the right position for the flame.

It consists of a piece of brass tube, any size, bore from ⅜ in. up to 1 in. will do, about 5 in. long. A bottom is soldered on about an inch up the tube, and a piece of wood put on for a handle to hold it by. The blowpipe is the same as just mentioned, fixed on the side in any way you like; some solder it to the tube, others fit it up with a joint, so that it can be moved in or out of the flame as required. But I think an improvement on either plan is to make a short tube to slip fairly tight on the 5-in. tube, and solder the blowpipe to this. Bend the blowpipe till it is in the right position for the flame, then it is always right, and can be slipped off if wanted. The lamp tube is packed with cotton-waste, and when wanted for use pour benzoline on to saturate it, and then pour off again. It is as well to have a cap of some sort on the top when not in use.

Fig. 12 is a gas blowpipe. This, it is obvious, can only be used in the workshop, or where there is gas to be had. The sketch explains itself. G is the tube that the gas passes along; B is the blowpipe inserted through a hole in the gas tube and soldered along it; it is connected to any ordinary bracket or burner by means of indiarubber tube and a short piece of ditto on the blowpipe, with a bone or tin pipe mouthpiece. This is a very useful tool indeed, and should find a place in any workshop where gas is available.

There are also several self-acting blowpipes, or rather blowlamps. In these there is no blowing to be done with the mouth at all. One of these is the French patent blowing lamp, Fig. 16. This is in shape something like a policeman's lantern with the bull's-eye removed. There is a spherical reservoir on the top, with a filling screw and valve. A small tube leads from this reservoir down to the lamp; the lamp is charged with methylated spirit, and the reservoir on top half filled with the same; the lamp is then lit under it, and in a minute it commences to blow a strong flame—a very useful article. Figs. 13 and 14 show an improvement on this lamp, called the patent regulating flame torch blowing lamp. It is sold by Messrs Rhodes, and is highly recommended by them. By moving the wheel marked A with the thumb (whilst holding the lamp with one hand), the regulator of the wicks can be effectively controlled by the slide, C, and any extent of flame produced. This is a great improvement, as it is often desirable to be able to make a smaller and less fierce flame. There is also a new blowlamp that I must mention. It has not long been out; in fact, I think I am the first to mention it in any journal; at any rate, I have seen no account of it myself. It is the invention of a Frenchman, Dr. Paquelin, and called after him the "Paquelin lamp" (Fig. 15). Benzoline is used with it, and it gives out a very fierce flame. It is sold as a paint-removing lamp, but, thinking it would be useful for many other things, I made some experiments with it. I found that for large lead joints it is first-rate, but it is too strong for anything smaller than 1-in. lead pipe. I recommend our plumbing friends to try it for wiping joints, or for such jobs as cracks in lead roofs, instead of using an iron and metal pot. I am sure they will find it a valuable accessory. But perhaps the most wonderful performance of the lamp is the following: I had a pair of buckles off an officer's belt to alter; the strap loops were too wide for the belt, and I had to make new loops and braze them on to the ornamental buckles. Well, this was rather a ticklish job, with no other means of doing it than the ordinary smith's forge. However, the thought struck me, try the Paquelin lamp. I did so, and the result was better than I expected, and I made a capital job of them, the spelter running like butter. Since then I have brazed a new bow to a key, soldered a silver ring, and sundry other jobs, so can say from experience that it is a capital lamp. So much for its performances; now for a word or two of description.

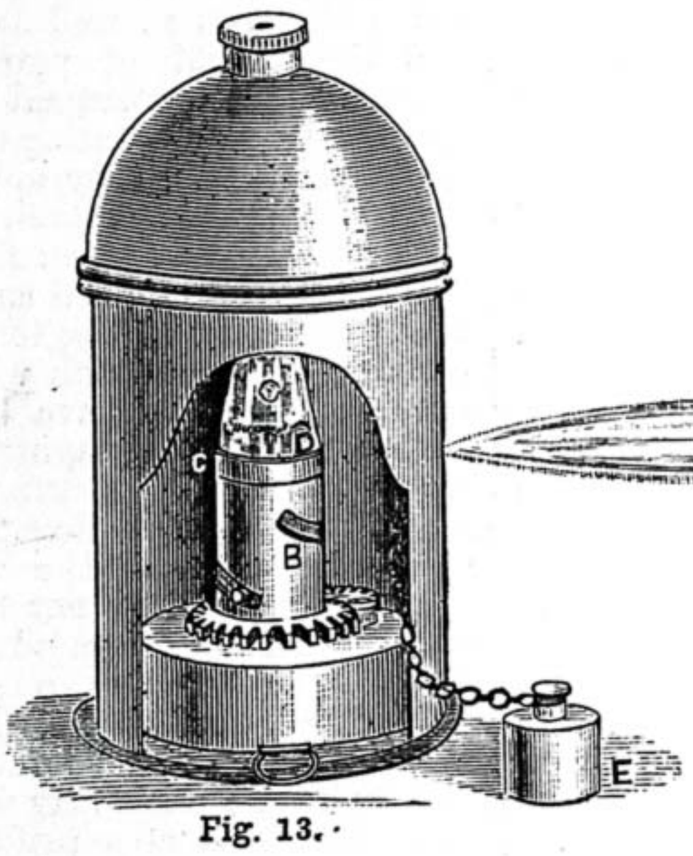

Fig. 13.

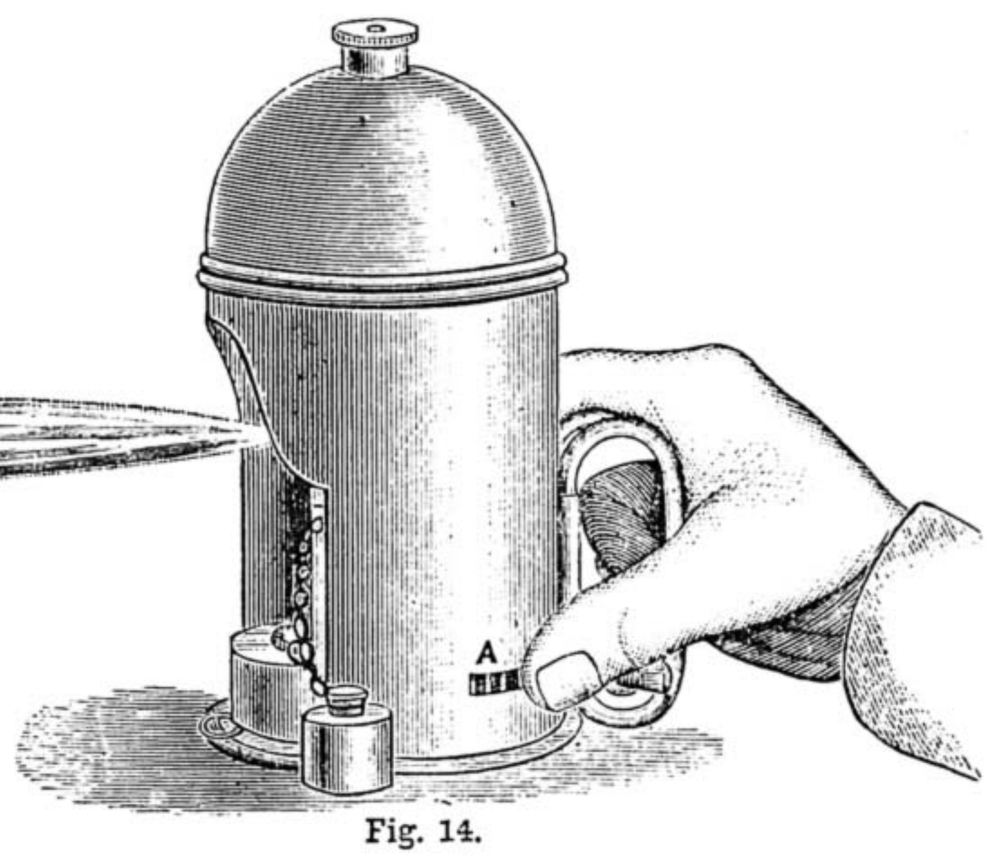

Fig. 14.

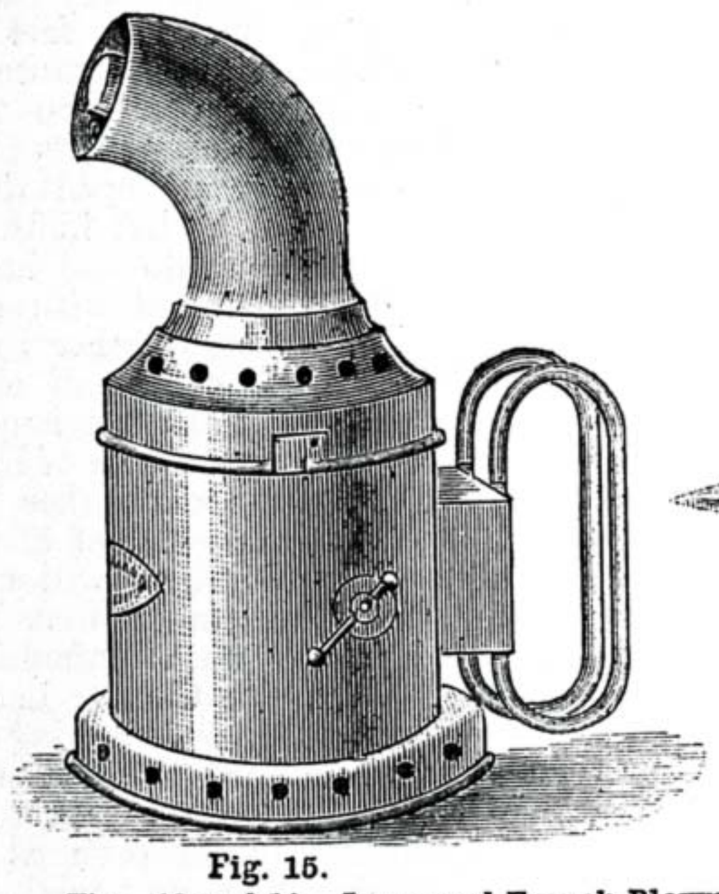

Fig. 15.

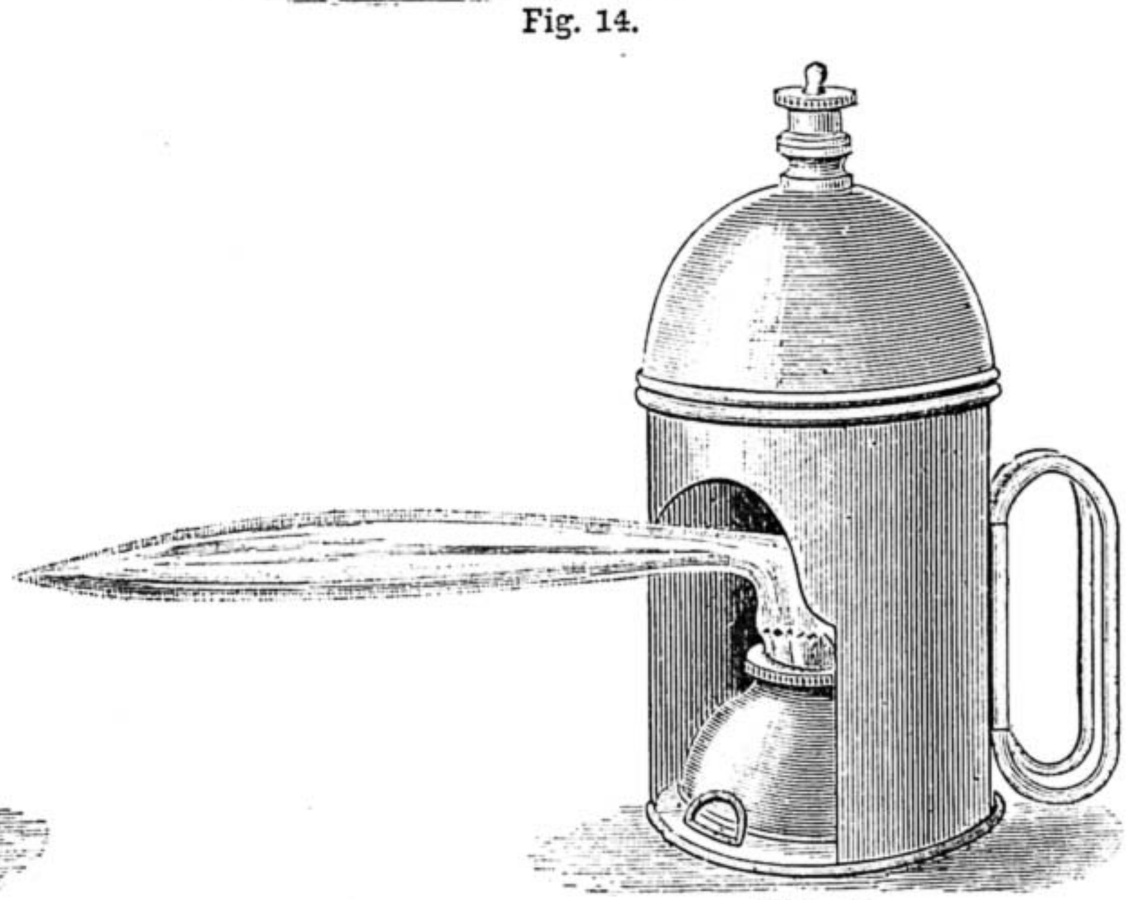

Fig. 16.

Figs. 13 and 14.—Improved French Blowpipe. Fig. 15.—The Paquelin Lamp. Fig. 16.—French Blowpipe.

It consists mainly of three parts—first, a brass body with a wick and some absorbent material inside, and with a capital filling screw with a little vice handle, so that it can be easily unscrewed: a tube runs up the centre of this body for supplying air; second, an inner bent tube of brass, which is slotted to slip over a crossbar, which has a very fine needle-point hole through which the benzoline vapour rushes and ignites at the mouth of the tube; third, an outer tube of sheet iron, which is fixed to a sort of dome which has holes all round it for air; this slips over the inner tube on to the body of the lamp, and is kept in place by a kind of bayonet fastening or stud slot. To set in action remove the filling screw, and fill with benzoline; then stand it upright in some vessel and let as much run out as will; screw

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up the filling screw, pour a dessert-spoonful of benzoline in the circular trough in the top of the lamp (having previously removed the outer tube), replace outer tube, and light through the air holes; in a minute or two the flame will begin to puff out, and by the time that the spirit in the trough has burnt out the lamp will be in full go. It can be used in any position, sideways, upside down, or anyhow; laid on its handles, with something put through them to keep them from slipping, it will boil a kettle suspended over it very quickly, so that if hard up for a fire you can make your tea or coffee by it.

Having thus described its advantages, I must, to be fair, state that it has a defect. What is that? you say. Will it explode? No; it is quite safe. Will it blow out easily? No; it can be used out of doors as well as in. But its defect is that it makes a great noise whilst working. If you can put up with this it is all right. The English agents for its sale are Messrs. Crowden and Garrod, Falcon House, Southwark Street, S.E., who inform me that they are having a great demand for these lamps, and that they cannot get them fast enough, a proof that I am not alone in my estimation of them.

PRELIMINARY GOSSIP ABOUT POLISHING WOOD.

BY DAVID DENNING.

PROBABLY there are no operations about which there is more popular misconception in connection with the finishing of furniture than the distinction between varnishing and polishing. I do not of course refer to those who are practically acquainted with the furniture trade, or even to those amateurs who have devoted some attention to the subject, but to the large number of people who, when they see a glossy surface on wood, describe the finish indifferently as varnish or polish. The words are, in fact, synonymous in their estimation, and to a certain extent rightly so, for there can be no doubt that French polish is a varnish, though no one who knows anything about it would think of regarding varnish as French polish. Though there is no difficulty to any one who is acquainted with the work in recognising the mode of finishing which has been adopted with any piece of furniture, it is not altogether an easy matter to explain the distinction so that there may be no fear of being misunderstood, for, as has been said, French polish, strictly speaking, is a varnish. No practical man, that is, no man conversant with furniture, would think of confounding the two terms, polish and varnish; but if asked to explain the difference he would probably not be able to do so. The inquirer would most likely be told in effect that varnish is laid on with a brush, while French polish is applied by means of a rubber. This explanation is correct as far as it goes; but it does not go far enough, and even practical French polishers will be none the less capable as executants for knowing at least a little about the theory of the work. By this I do not wish to imply that acquaintance with the theory, with the reasons why certain operations are performed, is essential before a man can be a competent worker, or that a knowledge of theory alone will make him so, but I do say distinctly that the old rule of thumb style of work is not the best possible for the aspirant to skill to be contented with. The man who is satisfied to work solely and wholly in the old grooves is not the one to devise improvements. Now and again he may hit upon some modification of old methods, which may result in improvement, but, taken as a whole, advances in any branch of workmanship emanate from the man who thinks. He takes advantage of every deviation from anticipated results; every accident, every partial failure sets him thinking of the reasons for them. He is not satisfied with knowing that they are, he must go further down and find the cause. He is then able to act intelligently, as a man endowed with brains as well as with eyes and muscles should do. Instead of being a digital machine capable of more or less endurance, he is a reasonable being not deficient in ability to act on his own responsibility when need arises. Traditional methods may be very well in their way, but I would ask any one who is conversant with workshop life, What is the difference between the foreman, or if you prefer it "the boss"—a young man perhaps—and yonder grey-haired, steady-going man, who, though a walking cyclopædia of wrinkles in his trade, has never advanced beyond the journeyman state of existence? The latter knows as much, nay, possibly very much more, so far as manual experience is concerned, than the former, who, however, has the advantage of being able to use his head as well as his hands. In other words he knows something of the theory of his business, and consequently is able to take the lead, to direct others who, either through incapacity or the fallacious idea that head work is only required in the counting-house, or by professional men, have allowed their natural talents to lie fallow.

Although these remarks are made here they are of general application, more especially in a handicraft which, like polishing, partakes a good deal of the nature of an art; or to put the meaning in the plain words of the workshop—knack is the great thing. Without knack, or art, no one can hope to be a good polisher, however much he may know about the materials and their manipulation, and of course the knack of the polisher's craft is not to be acquired without practice. A collection of receipts and instructions is all very well in its way, but I must freely confess that beyond indicating to the novice how to proceed in certain well-defined cases, and telling him the general features of the work, very little, indeed nothing, can be done by any verbal description which will make him proficient. Not long ago a friend was asking me some particulars about French polishing, which he regarded as a mystery rather than an art to be acquired. The mystery certainly exists, though it may not be apparent to the beholder till he actually tries to do the work himself. It then dawns upon him that the way the polish or gloss refuses to come up under his hands is indeed mysterious. It looks such easy, almost lazy, work, albeit somewhat tending to dirty the hands, that the novice may be pardoned for thinking he has not got hold of the right stuff, or that he has been misdirected. Of course, either of these circumstances may be the cause of failure, but it is much more likely to be owing to want of skill. That there is a good deal to be learned in connection with polishing is undoubted, and though much may be explained in black and white, mere written instructions cannot do much more than indicate the course to be pursued when polishing woodwork.

Possibly all this may have a discouraging effect on the novice, as without intending to do so, I may have led him to believe that polishing furniture or woodwork is not to be accomplished satisfactorily without a thorough training in the art. In case any one supposes this, it may be said that everything will be done in these pages to remove difficulties and to indicate right methods of working. The beginner, whether he be amateur or professional, will thus be fairly started, and perhaps it may not be out of place to remind him of the old adage, that "Well begun is half done." Please note only half done, and the other half will rest with himself.

It cannot be expected that the tyro, however clever he may be, will be able to finish his work as well as those who have had the benefit of years of experience. That would be unreasonable, but I may be pardoned for just hinting that some novices are slightly so. They appear, if one may judge from some of their attempts, which have naturally ended in failure, or at least met with very qualified success, to imagine that they ought at once to do as well as the cunning workman with whom the ins and outs of his trade have become almost a second nature. In saying this there is of course no wish to dissuade any ambitious aspirant to skill in French polishing from trying to succeed. The warning is given merely that he may not be discoura ed if his first attempts do not reach his expectations. Very likely to an expert they might be satisfactory, that is, when the learner's limited experience is taken into account, although the worker may not be contented. It is somewhat of a platitude to say that excellence can only be obtained with practice, but this fact seems so often forgotten that I venture to do so. What with other articles to which this is preliminary, and answers in the "Shop" columns, it is hoped that no readers of WORK will be left in the dark as to what they ought to do and how to do it, on any matter connected with finishing furniture by polishing, whether by French or other process. The wish of all concerned is to make the directions helpful to those who have no other source of information, so that if the advanced polisher should be inclined to think that some of them are superfluous, as they doubtless will be to him, he will kindly remember that I am writing for those who are as unfamiliar with his trade as he is with theirs. Let him imagine he wants to know something about one of these to him unknown trades or handicrafts. He will want to be told as a beginner, not as a journeyman, or even as an improver; no detail will be too trivial for him, and even then he will require to use his brains. Well, the kind of information the skilled polisher would require in other branches of work before he could make a fair start in them is exactly what I aspire to do for those who, however clever they may be in other directions, know nothing whatever about polishing. That polishing is a subject which many readers of WORK desire information about is apparent from the many references to it which have appeared in the "Shop" pages. Unfortunately, owing to insufficient details being given in the inquiries, it has not always been possible to answer them so fully as might have been wished, and it is hoped that all difficulties likely to occur to the novices will be anticipated. If not, may I ask inquirers in future to state definitely what they want to know, or at what point difficulty arises; or, in case of failure, if they will describe their *modus operandi* as clearly as they can,

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saying what the blemish or defect is? I ask this not as a personal matter for the Editor or his staff, but in the interests of inquirers themselves, if they are to be helped as much as the specialists whose duty and privilege it is to answer correspondents would wish to. In making these remarks, reference is naturally made principally to inquiries about polishing. For example, one man says he wants to polish something, and asks how he is to do it. Within the limits of the "Shop" columns it is impossible to tell him what he wishes to know, however much one would like to, for the all-sufficient reason that to do so would be to describe every kind of polishing. No doubt he only required to know of one of them, and that for one sort of timber. Such a question as that supposed admits of only a general answer, but had it been stated whether the inquirer wanted to finish his work with wax, oil, or French polish, bright or dull, together with the kind of wood used, a definite answer could be given. We, that is all concerned in WORK, publishers, editor, and staff, want to help correspondents in any matter which comes within the scope of the Magazine; but how can this be done if some inquirers will not, or do not, no doubt through inadvertence, give sufficient data to go upon? In connection with these remarks, I may say that many of the hints which will be given are based on inquiries from novices who have sought assistance from this and other technical journals. In fact, if I may venture on a personal allusion, there is hardly a detail which will be touched on about which a question has not, at some time or other, been put by a beginner. Thus, however incredible it may seem to the experienced polisher who may not have had the same opportunities of ascertaining on what details beginners want information, I think it may safely be said that all the hints to be given will be found useful, if not in their entirety, at least in great part to the majority of readers.

The question may arise, to whom are the directions likely to be of practical utility? To this, I would say firstly, to those amateurs who want to make and complete any piece of furniture personally; and, secondly, to those artisans and others in kindred trades, such as cabinet making, upholstering, etc., who would find the ability to polish in a fair and reasonable manner an additional source of income.

As is very well known in trade (I allude, of course, to the furniture trade) circles, the polisher's branch of the business is a distinct one by itself. The cabinet maker, the upholsterer, and the polisher are distinct personages, often, unfortunately, totally ignorant of any branch of the business beyond his own special one. Now, I would ask, is there any sound reason for this being the case? Would it not be well for, say, the cabinet maker to be able to do a little polishing when occasion required? Possibly, some of my practical readers may demur to this notion of any man having a right to encroach on the special calling of another. I have no wish to discuss such a question at present, but I do most emphatically say that, at the present time, the tendency is too much towards restriction in the sphere of labour. The artisan, the man, is in danger of becoming a mechanic, a mere labourer in some of our highest crafts. He is clever, or let me say rather an adept, in certain branches of his trade, but he is for all that only a wheel in the great machine, not as he ought to be, a complete piece of mechanism actuated by his head. In country places, and small establishments especially, the "handy" man, the man who, at a pinch, can turn his hand to anything almost with which his trade is even remotely connected, is the most valuable. Therefore I say, without hesitation, that the artisan connected with furniture, who is able to do polishing and all that appertains to it, will command a better market for his labour than the one who ignores everything outside his own groove. As already stated, this applies specially to those in country districts, but, even in the larger centres of population, facility in more than one branch of a trade cannot fail to be of advantage. With these remarks, this preliminary gossip on polishing must end for the present, but in future papers it is intended to treat of the whole "art and mystery" of polishing and its allied operations. All of these, however, cannot be treated "first," but the "Shop" is open to all inquirers who may choose to apply in it.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

98.—PATENT PIPE SOLDERING CRAMP.

THE Patent Pipe Soldering Cramp, of which various forms are shown in the accompanying illustrations, is a speciality of Messrs. Rhodes and Sons, Wakefield, and an appliance which all gas-fitters, plumbers, pewterers, etc., will find of the utmost use to them in the daily work that falls to their share to carry out. It is, indeed, intended to satisfy a want long felt by the trade, and to obviate the difficulties and prevent the loss of time occasioned by the want of an appliance by which ends of pipes to be soldered together might be brought into close contact, and held firm and steady during the process of soldering. The nature of the cramp will be easily understood from the illustrations, from which it clearly appears that it consists of a couple of jaws springing from a common origin, and brought into a relative position in which they are parallel to one another and of the same height. These jaws are regulated by a screw with a butterfly head, so that they are able to be separated to a greater or less degree, and, therefore, able to receive and hold pipes of different diameter. It will also be noted that by their means the ends of pipes can be brought into close proximity, and held in that position until the process of soldering is completed. To use the words of the inventors and patentees, "the Pipe Soldering Cramp is adapted either for gas or water pipes. It is easily applied to tubes of any diameter, as by merely screwing down one end of a tube in the cramp, the other can be brought into contact at once, and rigidly retained by the other screw, when the joint can be rapidly and effectually made. It also accommodates itself to tubes of different diameters, as, for example, $\frac{3}{4}$ and $\frac{3}{8}$ can be as easily held and soundly soldered by means of the cramp as pipes of equal diameter. It is very portable, being never larger than an ordinary hand vice, easily carried in the tool basket, simple in construction, and not liable to breakage." The two smaller sorts, shown in Figs. 1 and 2, are adapted for soldering tin or composition pipe, and are provided with a joint at the back to accommodate pipes of unequal diameter. The cramp shown in Fig. 2 has a bench screw attached to it, by means of which it may be secured to a bench. The larger cramp shown in Fig. 3 is expressly made for lead water pipes and tubes of larger diameters. The cramps are made of best malleable iron. The tin and composition pipe soldering cramp, shown in Fig. 1, is sold at 2s. 6d. That shown in Fig. 2 with bench screw, forming the gas-fitters' screwing cramp, is supplied at 3s. The third form, shown in Fig. 3, known as the plumbers' cramp, may be bought for 7s.; but the same sort of cramp, made in ordinary cast iron, instead of malleable iron, may be had for 5s. It should be said that this cramp is made and supplied in larger sizes and stronger form, so as to be serviceable in the same manner for holding iron pipes while being connected.

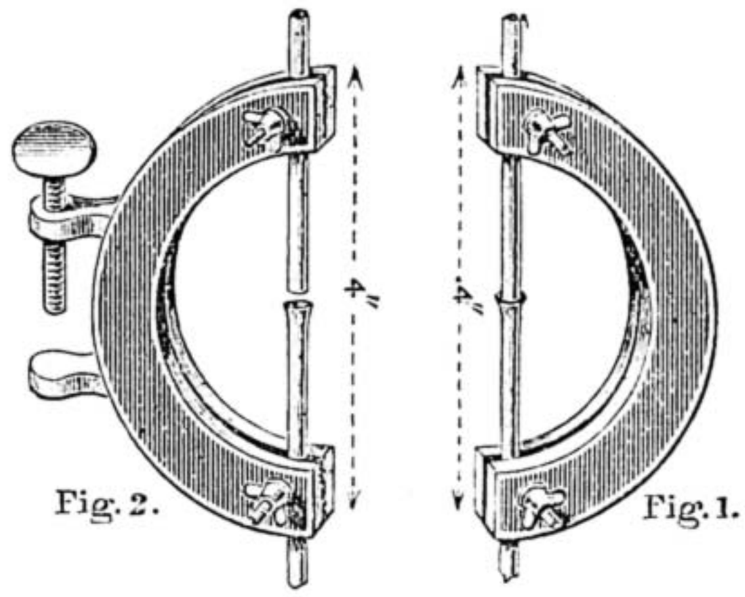

Fig. 2. Fig. 1. Fig. 3.

Fig. 1.—Tin and Composition Pipe Soldering Cramp. Fig. 2.—Ditto with Bench Screw, forming Gas-Fitters' Screwing Cramp. Fig. 3.—Ditto, Plumbers' Cramp.

99.—ZILLES & CO.'S NEW PRICE LIST.

Mr. Henry Zilles, whom I must heartily congratulate on having developed into Zilles & Co. by a natural process of evolution and expansion, has just issued a monster price list, No. 39, cancelling lists Nos. 32 to 37, which, in their turn, cancelled previous lists. These lists, I may say, contained only selections of fretwork patterns kept in stock by Mr. Zilles, but this giant list of twenty-two folio pages, each measuring 17 in. by 11 in., exhibits every design in miniature that may be made up from the patterns supplied by Messrs. H. Zilles & Co., 24 and 26, Wilson Street, Finsbury, London, E.C., from No. 1 to No. 838 inclusive. These are principally fretwork designs, but a note on the last page enables the reader to discriminate between designs for fretwork, designs for carving, and designs for inlaying and wood painting. List No. 38, I may say, contains a catalogue of cabinet fittings, mouldings, fancy woods, and tools, and is supplied post free at 4d. Mr. Zilles, apparently, has omitted to give the price of list No. 39, or I have failed to find it, so I cannot give it: but this, any reader who will take the trouble to write for the information can ascertain for himself. At all events, when any one has possessed himself of lists Nos. 38 and 39, he will know all about everything that Messrs. Zilles & Co. keep in stock and supply, and will have no difficulty whatever in finding something to suit him in the way of materials, tools, and patterns, unless the multiplicity and variety of designs offered for his selection reduce him to such a pitiable state of indecision that he finds himself utterly unable to make up his mind as to what to choose and have. I must not conclude my notice of Mr. Zilles' specialities without calling attention to "The Amateur," a clever monthly publication of continental origin, issued by him, and which appeals to all fret cutters, wood carvers, inlayers, and decorators of furniture.

THE EDITOR.

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SHOP:

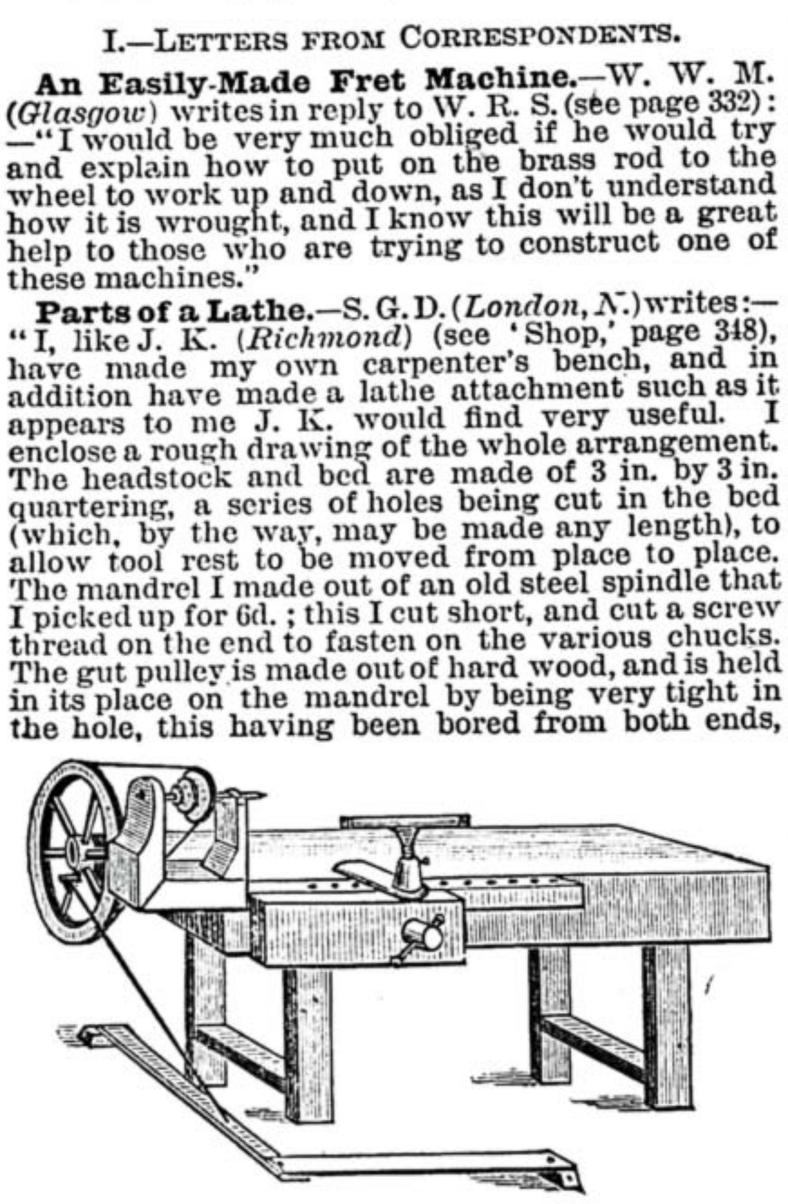
A Corner for Those who Want to Talk It.

⁂ Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

An Easily-Made Fret Machine.—W. W. M. (*Glasgow*) writes in reply to W. R. S. (see page 332):—"I would be very much obliged if he would try and explain how to put on the brass rod to the wheel to work up and down, as I don't understand how it is wrought, and I know this will be a great help to those who are trying to construct one of these machines."

Parts of a Lathe.—S. G. D. (*London, N.*) writes:—"I, like J. K. (*Richmond*) (see 'Shop,' page 348), have made my own carpenter's bench, and in addition have made a lathe attachment such as it appears to me J. K. would find very useful. I enclose a rough drawing of the whole arrangement. The headstock and bed are made of 3 in. by 3 in. quartering, a series of holes being cut in the bed (which, by the way, may be made any length), to allow tool rest to be moved from place to place. The mandrel I made out of an old steel spindle that I picked up for 6d.; this I cut short, and cut a screw thread on the end to fasten on the various chucks. The gut pulley is made out of hard wood, and is held in its place on the mandrel by being very tight in the hole, this having been bored from both ends,



Lathe and Bench.

that is, half way through from each end, and meeting a very little out of truth in the middle; this made it very hard to drive the mandrel in, and consequently it holds very securely. Having fixed the mandrel in the headstock, I proceeded to roughly shape up a part of the wood, and form a groove for the gut to run in; as soon as this was done I was able to turn up the pulley properly. The mandrel rests in a simple plummer block in the front. The fly wheel is about 22 in. in diameter. The lathe is a 9-in. centre. The whole cost was not more than 14s. or 15s. I consider Work is a very excellent publication; subscribers should read every number through, as they will gain an amount of knowledge upon different subjects that is sure to be useful at some time or other, though many of the matters treated upon may not directly interest them. 'Knowledge is power.'"

An Easily-Made Fret Machine.—Blockhead (*Penicuick*) writes:—"I see in No. 21 of Work, p. 332, a fret machine by W. R. S. Would he kindly let me know how he gets the brass pipe to run straight up and down when it is connected to the crank, and what size of table, and how made? Does the wheel go round?"

Flour, Emery, Rouge, and Pitch.—Micro (*Portsmouth*) writes:—"I want to know a simple way to wash flour, emery, and rouge, in small quantities, say, an ounce or two of each; and the best sort of pitch to use for polishing lenses, and whether it should be worked on cloth over the pitch, or the pitch only."

An Easily-Made Fret Machine.—G. P. (*Islington*) writes in reply to W. R. S. (see page 332):—"Explain more fully the working of crank and its connection with the vertical rod. The sketch in No. 21 of Work is anything but clear. Is there not some error as to the fitting of C with A? I am anxious to construct the machine, and have by me several parts which could be utilised, but cannot at all see how the upright motion is to be got by the present sketch. I thank most cordially W. R. S. for his little invention."

An Easily-Made Fret Machine.—Nemo (*Manchester*) writes in reply to W. R. S. (see page 332):—"I am a subscriber to Work, and having seen therein a sketch of an easily-made fret machine, I beg to ask a question relating thereto. I wish to know if the bottom end of the brass gaspipe used in its construction is fastened on the crank of the wheel, or how or where is it fastened, as the drawing does not enlighten me on that point."

An Easily-Made Fret Machine.—A. H. H. (*Leicester*) writes:—"The easily-made fret machine in No. 21 of Work, page 332, by W. R. S., does not seem so easy after all to an amateur. Should like to ask W. R. S. how the treadle crank is fixed to the wheel, and what part the wheel plays in the vertical motion of the machine. I wish that excellent paper, Work, every success."

II.—Questions Answered by Editor and Staff.

Soldering and Frosting Aluminium.—W. E. T. (*Aston, Birmingham*).—Recipes for solder were given in No. 15 of Work, June 29th, on page 237, and here is another for you to try your hand at if you care to. Aluminium, 6 parts; copper, 4 parts; zinc, 90 parts. Melt the copper first, and add the aluminium; stir it up with a clean piece of iron, then put in a little tallow, and add the zinc; stir it up again, and pour it as soon as you can after it is properly melted and mixed. You see that this alloy, as well as the others, is very much like pewter solder. It should be used in the same way—namely, by "tinning" the edges of the work first; then bring the parts together, and heat them until your solder runs, which it does not do nicely. A piece of aluminium, used as you would a copper bit, will help, I mean by rubbing it along the seam, when your solder runs. You note the flux mentioned in previous paper. But after all, this metal is generally worked up as you have done—viz., pinned it into a bezel; if it is soldered the seam cannot be left with the solder showing (at least none that I have seen is), it must be covered up; therefore bezels are a necessity, and that being so I make them do all the work. Without doubt this want of a solder prevents the use of this metal, and when one is discovered to match aluminium, and be principally made from it (just as our gold and silver solders are made from these metals), then we shall unquestionably use it to a very great extent. It is nearly time this was found out, for aluminium has been in the market for over fifty years, and in the direction of solders we are not a bit advanced, as far as I know, and as I am now placed, I expect that I shall see the results of any great improvement as soon as anybody, even if I do not at first get hold of the methods. As to frosting—I suppose you polished it with water of Ayr stone (one writer recommends a mixture of rum and oil to dip the stone in) and crocus. Then I anneal it and put it in vitriol pickle; it comes out with a fair surface, but I got my gilder to scratch-brush it as well, for my lathes are not powerful enough. It finally came out a decent sort of frosted surface, but nothing like frosted silver. It will not match the surfaces we get on silver, either by frosting or polishing, and I have had several attempts at it myself, besides getting a steam polisher to try it. Do any of our readers know of better ways of working this metal? If so, will they help their fellow workmen by sending an account of their tried methods to the Editor?—H. J. G.

Egyptian Trellis Work Screen.—T. E. P. (*Cambridge*).—My acquaintance with Egyptian trellis work was acquired in Cairo, and I know of no firm in England which does this work. Mr. Hatoun, dealer in Oriental goods, Mouski, Cairo, is the leading manufacturer of trellis work in Egypt; and I have always found him honest and obliging. Any handy English turner, however, should be able to make what you require, with a little practice. The idea is simple, and a good workman would originate little alterations in detail, which would give variety of pattern. Perhaps H. C. T. (*Newcastle-on-Tyne*), who recently wrote to me on the subject, would communicate with T. E. P., as he has some experience in this work.—C. H. O.

Polishing Picture Frames.—F. B. (*London*).—The best way to finish picture-frame mouldings, whether black or in the natural colour of the wood, is by French polishing, unless, of course, they are gilt or painted. Possibly you are referring to the cheap continental mouldings, which are faced with compo, and, as you say, are finished partly dull and partly bright. You will find it simply waste of time to make these for yourself, as they are sold at such low prices, and always in a finished state. If, however, you wish to polish ordinary wood mouldings in such a way as to resemble them, you must stain and finish in the usual way. You will not have much difficulty in finishing either all bright or all dull, but you will not find it an easy matter if you want some members bright and others dull, and unless you are a skilled polisher, which I take you are not, I do not advise you to attempt this. You will find it almost impossible to get a clean finish, but, if you are inclined to try, you must first polish all bright and dull down the parts you wish dead by rubbing them with a little very fine emery, or similar sharp cutting powder.—D. A.

Furniture.—Slip Jack (*Liverpool*).—Your inquiry is an admirable specimen of the kind which shows that some information is wanted, but that the writer has not troubled to give sufficient details to enable any one to assist him satisfactorily. I can only guess at the points you want to know about. Whether you want to renovate the leather or the woodwork is not shown in your inquiry, and each requires different treatment. I shall assume it is the latter, but here again I do not know how the wood has been finished nor its kind. To show the importance of these particulars, it may be said that oak wax polished would require very different treatment from mahogany French polished. I am, therefore, only able to answer you in general terms. The work must be cleaned either by washing with soap and water, or with the cleanser composed of vinegar, oil, and glaze (or methylated spirits), already described in these columns. It must afterwards, if necessary, be repolished, using a suitable polish. Very possibly, after cleaning a little glaze may restore the brightness, but, on the other hand, the work may have to be entirely repolished. The liquid "French polishers rub on with a rag" may be either a reviver, a wash to clean, oil, French polish, methylated spirits, or glaze, according to circumstances. Had you sent your address and name, I might have asked you for more details about the furniture you want to do up, and then been able to reply more definitely.—D. A.

Clock Case.—J. M. (*Pollockshaws*).—The dimensions of a clock case must depend on the size of the works. You say you have these, and I can hardly imagine you will experience any difficulty in working from the design alluded to by you. All you have to do is to reduce or enlarge the various parts proportionately, *i.e.*, if you wish to adhere to the proportions shown. You may, however, alter these considerably if you wish, but, unless you have some experience in designing, I can scarcely advise you to do so. If you like to send on the sizes of the works you have, I will give you my ideas of a suitable sized case, but as my ideas may not coincide with yours, I do not know that you will be much assisted by them.—D. A.

Wood for Turning, etc.—J. H. S. (*Brighouse*).—The kind of wood for table legs depends altogether on the sort of table you want to make. Any of the ordinary furniture woods are suitable, and the one that is best for the purpose must be determined by circumstances. You would, for instance, hardly choose mahogany, rosewood, or walnut for a common kitchen table, nor, though pine or beech would do very well for it, you would not regard them as the best for a handsome drawing-room piece of furniture. In your case, as you say you know nothing about turning, I should certainly not recommend you to use anything more costly than pine till you have acquired some skill in the use of your lathe. Table legs are too big for you to make your first attempts with. Try something smaller at first, working on any odd pieces which will be of little consequence when spoilt. You cannot expect to do anything worth keeping at first, so it would be simply waste to begin with expensive wood. You will soon find your ability growing, especially if you get a fair start, and you will then be able to regulate your efforts by your capacity. We must, you know, all creep before we can walk, but I fancy your idea is to walk without preliminary practice. As you do not know anything about turning, I should strongly advise you to get a friendly turner to put you in the way of using your lathe. Papers on wood turning for beginners will appear in due course, and possibly one which may assist you may be published shortly, but to give all the particulars which a novice would require in "Shop," is, of course, out of the question, much as I would like to assist you. Any light wood can be stained mahogany colour, so that pine, American white wood, beech, and others of similar character, would do for your bookcase.—D. A.

Polishing and Staining.—Round O (*Arbroath*).—It is a pleasure to answer such a letter as yours, because it states clearly what you want to know, and by describing the process you have pursued I am able to recognise the cause of your partial failure. In the first place you have used far too much oil with the polish, if, as I understand, you have moistened your rubber with one-fourth oil. You should have used French polish alone on the wadding, and just touched the covering with the least trace of oil to allow the rubber to go smoothly over the wood. I can quite understand your plan taking a very long time, and being tedious. You have also, as you appear to think, used far more polish than necessary by filling the grain with it instead of with a cheaper material. As you have watched a French polisher at work you apparently know the routine, but are unacquainted with the materials, so I do not know that I can assist you in a better way than by telling you what these probably were in the case of the counter top you mention. The polisher may have worked in a slightly different way from that described, but if you follow the instructions you will get good results. The counter top was first darkened by the application of raw linseed oil either in its natural state or mixed with some colour. The next material would be a filling, though from you stating that the first was a "thickish compo," I am inclined to think the order of oiling and filling was reversed from that here given, which is the better of the two methods. Various fillers are employed, but you cannot do better than use one formed of whiting and turpentine mixed to form a paste. Some suitable colouring matter to match the wood, if this is of a dark kind, should be added to it—for example, for mahogany rose pink does well. Excess of filling is wiped off before using the polish rubber as above. After you have got the wood sufficiently bodied up with polish use a fresh rubber with spirits only to get the final gloss or shine, but you must be careful not to spirit off all the body. Great pressure is not requisite, but patience undoubtedly is, though you will find this process superior to yours, both in saving time and results. Oak may be darkened in several ways according to the colour required. One favourite method is by fumigation with ammonia, a process about which a paper is in hand, and will appear as soon as

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practicable. Oak so treated is, however, seldom French polished, being waxed or oiled instead. Bichromate of potash dissolved in water makes another good stain of an orange brown tone. For a purer brown you will find vandyke brown mixed with a little liquid ammonia to form a paste, after which it can be liquefied with water very good. This stain will also serve for walnut colour on birch. Of course you will understand you can get the various stains lighter or darker according to the quantity of water with which they are diluted. Articles dealing exhaustively with polishing are in hand and in preparation. A preliminary paper appears in this number.—D. A.

Carving Tools for Small Work.—A. W. P. (*Leytonstone*).—In reply to your query respecting carving tools necessary for executing the corners of picture frames, given in WORK No. 10, and for small work generally, six cutting tools would be sufficient—namely, three gouges, a firmer, and two narrow flat chisels. Most good tool shops keep an illustrated price list of Addis's carving tools, and by inquiring there you would at once see the kind of tools you think you are most likely to want.—F. M.

Carvers' Tools.—T. V.—In all probability the wood carver to whom you allude as being possessed of some peculiarly formed tools specially adapted for undercutting had them made for him. If you call on or send to Mr. A. S. Lunt, 297, Hackney Road, London, E., he will readily make any shaped tool for you that you may require.

Smiths' Work.—J. P. A.—The appearance of articles yet to come on "Smiths' Work" has been delayed for the preparation of some engravings of examples required to illustrate them. They will be continued, and clear, practical instructions given on the welding of iron and steel. You write:—"I was speaking about the articles to a friend, and told him that, so far, they had only gone into the history of the trade, and as soon as they came to the practical part they would drop off." Your friend is altogether wrong in his ideas on this point. The numbers of WORK that have already appeared are sufficient testimony to the fact that the writers are practical men fully competent to handle practical work, and the writer of the papers on "Smiths' Work" is no exception to this rule.

Stand for Flat Iron.—NO NAME.—A correspondent has sent me a design for stand for a flat iron, but he omits to give name and address. The design is scarcely fit for publication in WORK, but the sender is thanked for the trouble he has taken.

Model Shipbuilding.—ZERO.—Arrangements are being made for a series of papers.

Bird-Cage Making.—ZERO.—I have no article in my possession on making bird cages, but if any contributor sends me a paper on the subject that is likely to prove useful you may be sure that it will appear.

Crystoleum Painting.—H. J. (*Peckham*).—The article on "Crystoleum Painting," which appeared in No. 3 of WORK, page 42, was continued and completed in No. 4, page 58. I am afraid you are not a very close and attentive reader of the Magazine.

Incubator.—C. H. M. (*Barrow-in-Furness*).—A contributor is at work on a paper on the mode of making an incubator, but I am not aware of the capacity of the appliance to be described.

Rubber Stamps for Music.—G. P. G. (*Wakefield*).—I am afraid your idea of printing music by aid of rubber stamps is one that you can scarcely hope to carry out with success. There is music type which is set up just in the same manner as printer's type, and you can get this at a reasonable rate, and would find it answer your purpose. You would have to use your rubber stamps on ruled music paper, and you would, I think, find difficulty in placing your notes either directly between two lines or on a line as necessary. If you followed up the notion, I fear it would only terminate in disappointment.

Plane for Making Pipe Lights.—J. W. C. (*Lowestoft*).—A plane of this description will soon be described in "Home-Made Tools." In the meantime you may obtain one of Messrs. R. Melhuish and Sons, 85 and 87, Fetter Lane, E.C. You will find a nice clean piece of pine free from knots the best wood for your purpose.

Patent for Brake.—W. D. (*Huddersfield*).—Not having seen either drawing or model of your brake for wagonettes and heavy vans, I cannot tell you whether or not the idea is worth patenting. There will soon be a paper entitled "How to Take Out a Patent," and this, I hope, will be of use to you. I cannot undertake to publish drawings of carriages that you may send me, but I will look at them and tell you what I think of them.

Printers and Printing.—H. E. C. (*Wednesbury*).—By Act of Parliament (39 Geo. III., c. 79) printers are required to be registered by the Clerk of the Peace, the fee for which is 1s. The following is the form of notice required to be given:—

To the Clerk of the Peace for the
or his Deputy.—I,

of
within the , do hereby declare that I have a Printing Press and Types for Printing, which I propose to use for Printing at
within the
and which I require to be entered for that purpose, in pursuance of an Act passed in the Thirty-ninth Year of His Majesty King George the Third, entitled "An Act for the more effectual suppression of Societies established for seditious and treasonable purposes, and for better preventing treasonable and seditious practices."

Witness my hand this day of in the year

(Signed)

Signed in the presence of

You will not be liable to prosecution if you print your name and address on circulars, etc. You cannot use the Royal Arms. If you use your own crest or coat of arms a duty will have to be paid—in fact, the duty for using armorial bearings, namely, £1 per annum. If you use a block or coat of arms as a trade mark, you will have to print the words "Trade Mark" with it.

Condensing Pump.—TYRO (*Liverpool*).—The pump should answer for your purpose, and may be worked by hand, but it will be a slow process. If your plunger is one inch sectional area, and you can put 100 lbs. pressure on the handle, it must multiply twenty times, and your hand must move twenty inches for every inch travelled by the plunger. To get 15 cubic ft. of air at 2,000 lbs. per square inch, you must pump in 134 cubic ft. at atmospheric pressure, which will require a total travel of plunger of about 230,000 inches. Of course you can commence with a short leverage, and increase it as the pressure rises. The valves must be very accurately ground in to hold such high pressure.—F. C.

Wood for Greenhouse.—T. J. H. (*Derby*).—You had better purchase some 3-in. by 9-in. yellow deals at 3½d. or 4d. per foot run, and get them cut to the sizes you require. For instance, you say you intend using 3 in. by 1½ in. for the top of your greenhouse. (Do you mean for the rails of the lights, or for the framework?) Get the deal cut 5 flats, which will make six pieces of 3 in. by 1½ in. The standards and sill could be cut 1 flat—*i.e.*, 4½ in. by 3 in. Where do you propose putting the six doors? You can buy the sash bars ready for use at 1½ in., ¾d. per foot, or 2 in. 1d. per foot, and the match lining for the panels at ⅝ in. thick, 8s. per square, or ¾ in. 9s. A square will cover about 9 ft. by 9 ft., and can be had from 5 in. to 7 in. wide. If you are near Hull I do not know that you could do better than purchase them.—A. J. H.

Domestic Ventilation.—A. W. (*Liverpool*).—I have examined the models and drawings of the domestic ventilator, and think it well adapted to its purpose; it is ingenious, simple, and complete, and I do not know of any invention that anticipates it. I think it will be preferable to retain the two shutters behind the front plate, and it will then afford a clearer way for the current than if one only is used. The case need not be ¼ in. thick, and in fact might be made of sheet iron. The valve, C, will require a stop, to prevent its being thrown too far back by a sudden draught, so that it may be in a position to close if necessary. A. W. should be careful in drawing his specification not to claim too much; it is only in the details of construction that the novelty exists, as the principle has been applied before, and in the same position as proposed.—F. C.

Battery for Induction Coil.—A READER (*Glasgow*).—A pint Bunsen battery will be quite large enough to work your small coil. The cost of a complete cell will be about 3s. The porous cell, containing the rod of carbon, is charged with strong nitric acid (cost about 3d.), and the outer jar with oil of vitriol in water (a wineglassful of acid to a half pint of water), cost ½d. See article on Bunsen Battery in first three numbers of WORK. The vulcanite ends of the coil are easily made. Procure a sheet of ⅛-in. vulcanite, strike out the size of the ends with a pair of compasses, then the hole for the core, and cut out carefully with a thin, narrow saw such as a keyhole saw. Smooth the edges with a rough file, then glasspaper them, and polish as you would polish hard wood.—G. E. B.

Winding Dynamo Armature.—J. C. W. (*South Lambeth*).—From the sketches in your letter I learn that the armature of your dynamo is of the Siemens H or girder pattern. This is most easy to wind. Hold the armature with the commutator toward you, and commence winding the wire on the left-hand side. Work from left to right, placing each coil neatly side by side around the web of the armature. When the spindle is reached, bend the coils on one side until half the diameter has been passed, then bend the coils on the other side to cover the web. See that the covering of the wire is not chafed as it is being drawn tight over the ends of the web. When the first layer is on wind on another, and so go on forwards and backwards until the wire space is filled. Connect the commencing end of the coil to one segment of the commutator and the finishing end to the other segment of the commutator by small set screws near the inner edges of the segments.—G. E. B.

Battery for Coil.—ELECTRICITY (*Leeds*).—You have so mixed up a "galvanic machine" with "a battery," and this with "a bell," in your letter, as to thoroughly puzzle me. You do not describe your galvanic machine, but I suppose it to be an induction coil. You attempt to describe a battery, but here you fail, for the zincs could not work in "two indiarubber bags," and I cannot at all imagine what you mean by "a stop and brake." I can only guess the nature of your newly-acquired property and your requirements, so if I fail to help you it is your own fault, and you must be kind enough to write again, giving a more clear account of your apparatus. I think it possible you have got hold of a shocking coil, and two cells of an old form of Daniell battery, with pieces of ox-gullet for porous cells. This will be troublesome to you, as you know little or nothing about such apparatus. Nearly fill the copper jars with a mixture of a wineglassful of oil of vitriol in a pint of water, and hang the zincs in this from a rod of wood placed across the tops of the jars, so that the zincs cannot touch the copper. Take one connecting wire from one of the copper jars, to one of the connecting screws of your "galvanic machine." Connect the zinc of this cell by means of a copper wire with the other copper jar (the side of the jar itself), then connect the zinc of this second jar with the other binding screw of your machine. If the acid makes the zincs hiss badly, you must take them out and coat them with mercury by the method described in WORK in the articles on the Bunsen Battery, and also in the note on amalgamation on pp. 86-87. When you wish to stop the action of the battery, merely lift the zincs out of the acid solution, leaving this in the copper jars until again wanted. Discard the ox-gullet (indiarubber?) bags altogether.—G. E. B.

Drop Black.—F. B. (*Guernsey*).—Drop black is a kind of ivory black, but of a better description than that which generally goes by the latter name. It is supposed to be made of burnt ivory, but is really burnt bones. Drop black costs about eightpence a pound, while ivory black can be had at threepence. If you cannot obtain it easily use vegetable black for the receipt you refer to in "Tips for Tyros," as it will do equally well. As you do not say what material your frame is composed of, and I do not know what its surface is like, I cannot here give you explicit directions for gilding it. However, if you refer to WORK, No. 8, page 118, you will find a "Tip" which I think will help you.—OPIFEX.

Walnut Fret Wood.—S. O. P. (*Clapham*).—The following are among the best firms for every kind of hard wood in all thicknesses:—C. B. Snewin, Back Hill, Hatton Garden, and Ray Street, Farringdon Road; W. & J. R. Hunter, New Bethnal Green Road; Oliver & Sons, Bunhill Row. There are plenty of veneer merchants in and around Old Street, E.C.—A. J. H.

Shrunk Forms.—PERPLEXED (*Norwich*).—The difficulty experienced by you arises either from the mahogany boards having expanded or contracted, or the paper having stretched or shrunk. If the fault be with the paper, then the stretching will most probably not be regular. This may be discovered after printing first colour by taking sheets from various parts of the "heap," and holding two sheets together up to the light. If the printing fall exactly in the same place on every sheet then the defect must be in the blocks. If they have expanded dry them thoroughly. If this does not succeed, new "register" will have to be made by cutting the boards or relaying the electrotype plates.—J. F. W.

Automatic Machine.—MINER (*Willington*).—Your arrangement will not answer because, while one valve is closing another is opening and letting in a further supply. To make the thing work the top valve must shut first, then the lower valve open, and at the same time open a vent for air at the top of the measuring vessel. The removal of the glass from its stand may by a counterbalance be made to reverse the action of the taps. The arrangements would be more complicated than your sketch, and I doubt if it would pay you better to patent a new contrivance than to hire one like those in use in London for fresh water—½d. in the slot—at railway stations.—F. C.

Repairing Broken Saw.—MINER (*Willington*).—The only way of joining a broken band saw other than brazing is by electric welding, but that probably cannot yet be done in your district. In my own experience I have found it better in the long run to buy a new band saw than to attempt to mend an old one. In the matter of brazing, if well done it may last a while, but the difficulty is to get it well done, and even then near the braze the temper must be lost, and the endeavour to restore it will generally extend the evil, as the brazing will not stand the heat for rehardening.—F. C.

Barometer.—WEATHERGLASS (*Eastbourne*).—Wash the inside of the empty tube with water acidulated with aquafortis (one part nitric acid to ten parts of water) mixed in a small spouted jug. Pour this into the tube, and pour it out again two or three times, then rinse it with warm distilled water, and warm the tube to hasten the drying. Whilst the tube is still warm refill with mercury, shaking this in as you have done before to get all air bubbles out. The mercury may be cleaned by shaking it up and down in a bottle together with a mixture of nitric acid and water of the same strength as that used for cleaning the tube. When the mercury is bright, throw away the acid mixture, and rinse the bottle two or three times with warm distilled water. Pour the mercury into a basin and dry it with blotting paper, and finally filter through a piece of thin wash leather, or through a piece of linen.—G. E. B.

Tondeur Developer.—E. L. H. (*Begbroke*).—The Tondeur developer is probably compounded from a private formula known only to the vendors. Excellent developers are most easily and inexpensively made. Why not make your own? The following will work with most plates:—No. 1, pyrogallic acid, 6 grains; sulphide of soda, 24 grains;

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water, 2 oz. No. 2—pure carbonate of soda, ½ oz.; water, 2½ oz. Mix just before use. If the plates are very sensitive, or the exposure overdone, add a grain or two of potassium bromide, or less of the soda solution.—E. D.

Blocking Book Covers.—A. B. C. (*Liverpool*).—If our friend A. B. C. is a blocker he will find little difficulty in working the self-inking press he speaks of. In fact, it is a great deal easier to work than the ordinary blocking press. The table of the press has a to-and-fro movement which admits of great facility in feeding and setting up. When the press is doing inking work, the rollers pass over and repass the stamp by the movement of the table, and thus printed work is done with the same speed as ordinary blind work. The covers are fed when the table is out, and there is less chance of the gold getting rubbed off as in the old process. One or two sides and the back of cases can be done at one operation, using both gold and colour at once. Thus complete covers can be produced at the rate of 600 per hour. It is not necessary to use any size or prepare the cloth in any way to receive the ink. But in the better class of work it is usual to block the cases blind, and afterwards ink them in. The presses register so nicely this can be easily done. Of course, when putting on the ink the press must be cold. Book-cover ink is the proper thing to use, and may be obtained from any printing ink manufacturer. I expect you will get it readily in Liverpool. If not, send to Messrs. Richardson & Co. for a sample tin; use it as thin as possible, but not too thin, else you will not have the fine gloss that you should have. If you are getting a new press the maker will give you all the necessary instructions for working it; or, if you are going to a new place to work one, a glance at the machine, if you are a blocker, will be all that is necessary. I am very pleased to be able to help you; if you find any difficulty write again.—G. C.

Rabbit Hutch, etc.—A SUBSCRIBER (*Kingsland*).—Yes, a description of a rabbit hutch will, it is to be hoped, appear in due course. Full particulars will be given about it, but I cannot speak for the "allschow," as I do not know what sort of a thing this is, and I do not remember to have heard of one of them before. The preparation of dry plates is hardly suitable work for an unskilled amateur, the process being extremely delicate and tedious. However, for the benefit of those who wish to try their skill it will be described some time. For the present there are many articles of more general interest awaiting publication. You are, however, quite right to name any subject which you would like to know about, even though it should not be possible to give the desired information in "Shop," the space for which is limited.—L. J. P.

Renovating Stained Floors.—J. R. (*Liverpool*).—Although you refer to the floor having been stained only, it may be taken for granted that the surface has been finished in some way, probably by varnishing or waxing. If it has been polished with wax then it will most likely be sufficient to wash this off thoroughly with soap and water before applying fresh stain. A varnished floor is, however, more difficult to deal with, and I could only advise you definitely how to act by seeing its present condition. This, of course, is out of the question, so I must answer you in a general way. If the floor is in very bad condition, and you want to renovate it thoroughly, you must either scrape or plane it over. Papering will be superfluous, unless you want to French polish it instead of varnishing it. You may be able to wash the varnish off with turpentine, of which a good deal will be required. Possibly the varnish may have "perished," or been worn off entirely. Are you quite sure that the floor needs restaining? for it often happens that owing to the varnish having gone the impression is taken that the stain has also, whereas a coat of varnish will do all that is necessary. In any case you will not find it so easy to renovate a floor which has been stained as to stain and varnish an uncoloured one. You may not be able to match the stain exactly, for to do so requires the judgment of experience, and unless you can the result is apt to be patchy. I think if I were you, instead of staining the floor afresh I should paint it, using ordinary oil colour, as the appearance will probably be much better. After the paint has dried give it a coat of varnish. You may, perhaps, also attain your object by mixing a little colour, say, vandyke brown with the varnish, and so dispense with either staining or painting separately. If you still want a walnut stain here is one. Vandyke brown mixed to a paste with ammonia and water added till thin enough for use. The "Badger" is used like an ordinary brush, which will do just as well for your purpose. Of course make the strokes, as you call them, uniformly, and remember that the varnish on a floor is not so closely investigated as to cause brush marks of the ordinary kind to be noticed. Don't apologise. It is recognised as a pleasant duty by those connected with WORK to assist amateurs, and you seem rather "down" on yourself.—D. A.

Reversible Lathe.—J. F. P. (*Darlaston*).—In reply to your question respecting the possibility of reverse action of lathe, allow me to say all real self-acting lathes are capable of backward and forward action and stopping without interfering with engine, or shifting the belt from the pulley on which it runs, action and reaction depending, not on the pulley, but on the overhead riggers, and the train of wheels attached to the mandrel or geared into it.—G. E.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Fretwork Picture Frame.—AMATEUR (*Belfast*) writes:—"Would you permit me a little space in the 'Shop' column of WORK to ask if any brother reader could give me a design for fretwork picture frame? If so, he would very much oblige me."

Varnish for Drawings.—A. M. (*Glasgow*) writes:—"Could you suggest a good, hard drying varnish for coating drawings executed in colours on ordinary drawing paper? The varnish is intended to prevent the drawings being soiled by frequent handling, and it should be, as nearly as possible, colourless."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Drilling Square Holes.—P. P. (*Withington*) writes in answer to A READER (see page 270):—"There are drills in the market that are supposed to drill square holes, but there are none that drill them practically square, the majority leaving the angles round. The one of which I know is composed of four short drills on one shank, all working in the same direction, and close together, the whole enclosed in a square steel casing, sharpened on all sides, with the bevels inward. This drill needs much force to make it penetrate any distance, and unless you have a drilling machine, and a large number of holes to drill, it would not be worth while getting one, as the cost is large, and repairs are often needed. A new drill for square holes has been lately described in the *English Mechanic* as having a 'sun and planet' motion described to cut a clean square hole. Perhaps Melhuish & Sons will bring this to our notice in WORK, if it is found to be all that is claimed for it."—[A tool that will do this kind of work will shortly be noticed and illustrated in "Our Guide to Good Things."—ED.]

Sharpening Carving Tools.—J. W. B. (*Wakefield*) writes in reply to AMATEUR (see page 270):—"I grind my carving gouges almost equally from inside and outside. For the insides I use small emery wheels (such as dentists use), varying the size with the sweep of gouge. In doing this great care is required, so that the temper be not altered. The letter from H. C. (page 268) explains, I think, the reason why carvers do not generally use the handscrew for holding slips, but as I happen to have both bench vice and German screw in my shop, it did not occur to me for the moment that many carvers are without either. As to this method of holding slips being 'amateurish,' I can refer D. D. (page 252) to one of the oldest cabinet carvers who has used this system throughout a working life of over sixty years."

Joiners' Composition.—B. A. B. (*Hampstead*) writes in reply to J. R. (*Oldham*) (see page 270):—"Glue and whiting is frequently used. Glue and sawdust from the wood in use is frequently recommended. Glue and litharge is good for light mahogany. Plaster of Paris mixed with a little glue and venetian red, chrome yellow, and raw or burnt umber is sometimes used, but must be used quickly, and the glue must be thin. I have used a sealing-wax, which is made expressly for the purpose, and can be had in various colours to match different woods, at four sticks for 3d. at several shops near Curtain Road."

Tobacco-Pipe Making.—PIPER (*Manchester*) writes:—"In answer to SMOKE on tobacco-pipe making (see page 222), I must say that there is no book published on the above; but if SMOKE will publish his address, and state what he wants to know, I can, no doubt, help him."

Ivory Walking Stick.—P. P. (*Withington*) writes in reply to W. A. (*Hanley*) (see page 270):—"If you intend to cement it at the broken part, the best thing to use will be the new fish glue (Inventions Exhibition); but it will not stand much rough usage. A better plan would be to drill a hole in each end, and get a piece of round steel to fit; heat it *black* hot, and having filled each hole with resin and knife polish, insert the steel, and hold all in place till cold. This should make a splendid strong joint."

Rickety Table.—W. H. S. (*Willaston*) writes in reply to A. J. T. (*Holborn*) (see page 318):—"Get a piece of wood 8 in. long by 2 in. wide and 1¼ in. thick, which should be planed up. Mark on the piece spaces of two inches; with pencil and square run a line down the centre of the piece; then get a brace and bit, 1¼ in. would do, and bore a hole nearly through, according to size of castors; then get a tenon saw, and cut them across into pieces two inches square; take the corners off with a chisel, and place them under the castors on the floor. This is the best remedy that I know of for rickety table."

Spirit Level.—D. J. (*Oldham*) writes:—"Will any reader kindly tell me how to choose a tube for a spirit level, and how to fix it? Level is 9 in. long by 1⅛ in. by 1 in., with slot 4½ in. by ½ in."

Copying Music.—T. R. (*Gateshead*) writes:—"Seeing such a variety of questions so ably and willingly answered in 'Shop,' I wish to ask if you know of any appliance or quicker method of copying music than by hand with pen and ink? I am in a band, and wishing to have my copy or part always at home, it occurred to me to ask your assistance. I am not a moneyed person, therefore cannot buy a duplicate copy of every piece performed; the time taken up in copying might be more advantageously used upon the instrument, and also to advancement of band."

Trade Notes and Memoranda.

THE oldest steamer in the world, according to the *Steamship*, is lying in Bowling Harbour on the Clyde. The *Industry*, built in 1814, plied for about sixty years on the Clyde, and was finally laid up where she now lies. Last year the engine, a side-lever one with spur wheel gearing, was taken out and placed in the Kelvinside Park at Glasgow. The old boat is fast breaking up, and will doubtless shortly disappear. The engine, however, will show to future engineers what a side-lever engine was like, and how it was connected by gearing to the paddle shaft.

PRIZES to the value of £150, and twenty of the Society of Arts' bronze medals, are offered for objects of art or workmanship to be exhibited in the Arts and Crafts Exhibition in the New Gallery, Regent Street, to December 7th. The work must be the production, not of artists, but of craftsmen, and must have been executed in the United Kingdom, or its dependencies. The objects submitted for competition may be the work of one, or of several workmen in combination, and need not necessarily be the property of the workmen sending them in. Forms of application, and full particulars, may be obtained of Mr. Ernest Radford, Secretary of the Arts and Crafts Society, 41, Great Marlborough Street, W.

As others see us:—"The English shopman (workman) is hardly as reliable as his American contemporary, so far as working steadily is concerned. He takes more days off, his option to do so not being seriously questioned. He is also very tenacious of what he considers his rights, one of which is not to be hurried, and another to do nothing he is not hired to do. If he is a lathesman he could by no means be persuaded to work a week at the bench in an emergency. While the American shopman is usually glad of the opportunity to broaden his field of usefulness, with the idea that knowledge gained in this way will come into play some day, the English shopman will quit his job before he will work out of what he considers his sphere. It is not uncommon in America to see a shopman, with a carpenter perhaps to help him, putting up the counter shafts for and setting some tool which he has to run. In England millwrights must do this. A lathesman does not know how to do it, and he does not want to know how. Insisting upon his doing it would quite likely empty the shop of men. The course of the English workmen does not tend to make mechanics, but perhaps—though we question it—it tends, as is claimed, to make better specialists in the different lines of the machine industry."—*American Machinist.*

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Smallest Things in Planes.—Recommended in "Our Guide to Good Things." Walker's 1s. Nickel-plated Pencil Plane.—19, Legge Street, Birmingham. [2 S

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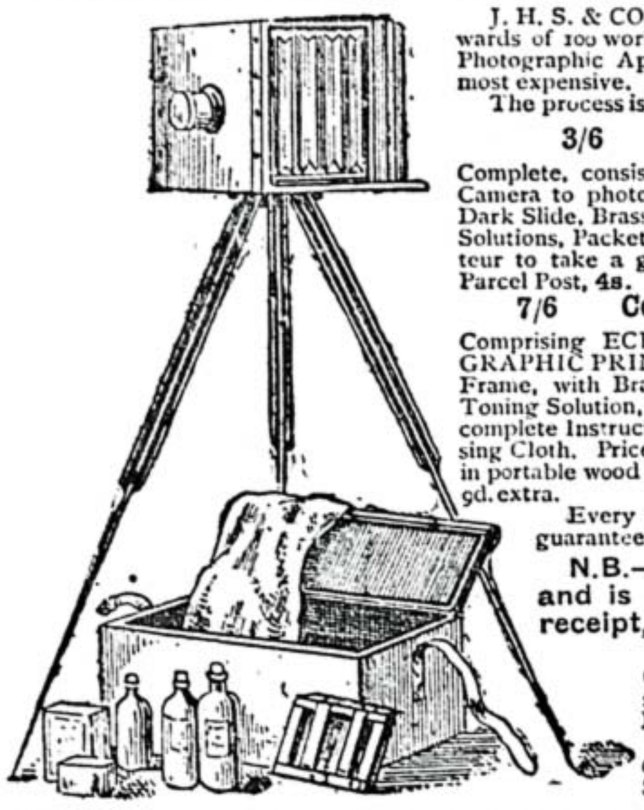

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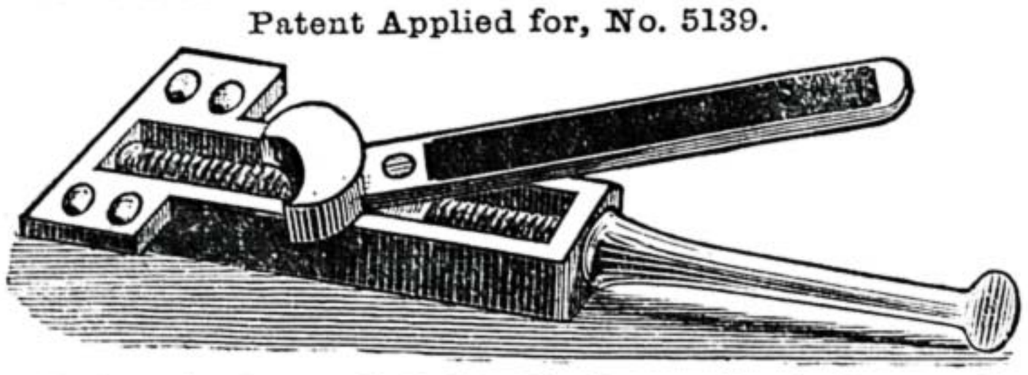

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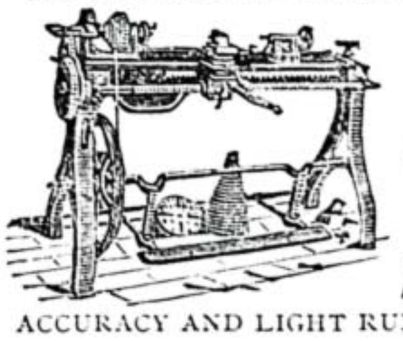

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